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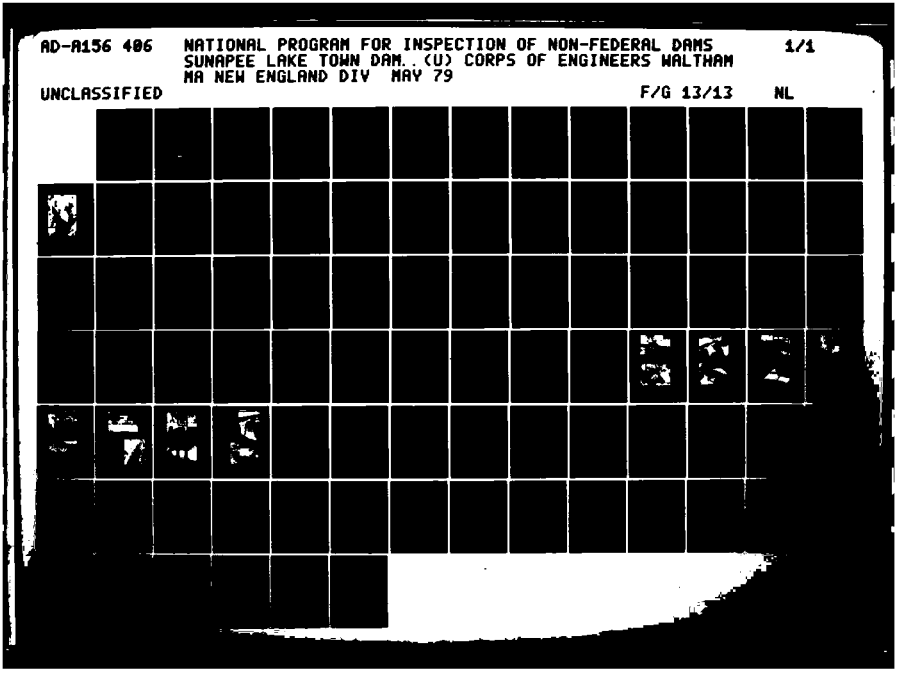

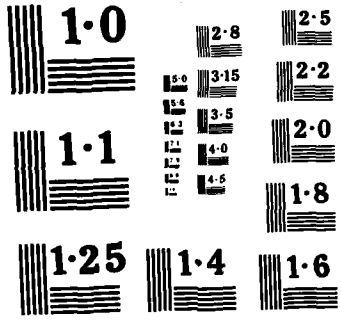

CONNECTICUT RIVER BASIN

SUNAPEE, NEW HAMPSHIRE

SUNAPEE LAKE TOWN DAM

NH 00108

NHWRB 229.05

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

MAY 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

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Connecticut River Basin
Sunapee New Hampshire
Sugar River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a stone masonry dam capped witha concrete slab over the upstream face. TXe dam is considered to be in good condition. It is intermediate in size with a high hazard potential classification. The extent of damage that might occur at the dam and in downstream areas in the event of overtopping should be assessed. There are various operating and maintenance measures which shoud be inplemented by the owner.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

SEP 6 1979

Honorable Hugh J. Gallen
Governor of the State of New Hampshire
State House
Concord, New Hampshire 03301

Dear Governor Gallen:

I am forwarding to you a copy of the Sunapee Lake Town Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Water Resources Board, the cooperating agency for the State of New Hampshire. In addition, a copy of the report has also been furnished the owner, Town of Sunapee, Sunapee, New Hampshire.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Water Resources Board for your cooperation in carrying out this program.

Sincerely yours,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

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SUNAPEE LAKE TOWN DAM

NH 00108

NHWRB 229.05

CONNECTICUT RIVER BASIN
SUNAPEE, NEW HAMPSHIRE

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM
PHASE I INSPECTION REPORT

Identification No.:	NH00108
Name of Dam:	Sunapee Lake Town Dam
Town:	Sunapee
County and State:	Sullivan, New Hampshire
Stream:	Sugar River
Date of Inspection:	June 6, 1978

BRIEF ASSESSMENT

Sunapee Lake Town Dam is a stone masonry dam capped with a concrete slab over the upstream face. The dam has a maximum height of 15 feet and is approximately 71 feet long. In the middle of the dam there is a 30 foot long spillway. Over the spillway there is a footbridge spanning between two concrete abutments. The spillway is 11 feet wide and approximately 4.5 feet below the crest of the dam.

Based on visual inspection, available records and past operational performance, the dam is considered to be in good condition. A settlement area was noted adjacent to the north abutment. Erosion of the concrete was also noted. One vertical member of the footbridge railing located at the northern end of the dam was observed to be missing. Continuance of this classification depends on proper operations and maintenance of the dam.

This dam falls under the category of high hazard potential, and it is intermediate in size. Flood runoff from the Sunapee Lake watershed goes more into surcharge storage then into spillway discharge. With a full probable maximum test flood (PMF) runoff of 19 inches with an estimated peak inflow of 65,000 cfs, the outflow would be reduced to about 9,000 cfs, with about 16 inches of runoff going into surcharge storage. Such flood would overtop the dam by about 4.2 feet. A flood one-half the PMF, with 9.5 inches of runoff and a peak inflow of 32,000 cfs would result in a spillway outflow of 1,700 cfs with about 9 inches of the flood runoff going into surcharge storage. This flood would result in only about 0.3 foot overtopping of the dam.

Because of the large surcharge storage feature of this project, it is recommended that within two years after receipt of this Phase I report by the owner, more detailed hydrologic studies be performed to determine the ability of this project, through storage and spillway capacity, to withstand major flood runoff. The extent of damage that might occur at the dam and in downstream areas in the event of overtopping should be assessed.

The owner should also implement the following operating and maintenance measures:

1. The settled area adjacent to the north abutment should be reestablished and a missing rail post installed.

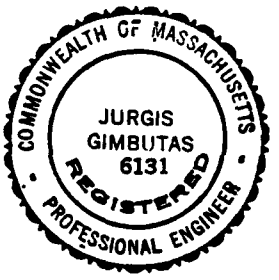
2. All eroded concrete surfaces should be repaired.

3. A program of regular maintenance should be established.

4. A program of technical biannual periodic inspection of the project features should be prepared and initiated.

5. A plan for surveillance and a formal warning system should be developed for periods of unusually heavy rains and runoff.

FAY, SPOFFORD & THORNDIKE, INC.
By:



Jurgis Gimbutas, P.E.
Project Engineer

Richard W. Albrecht, P.E.
Vice President

This Phase I Inspection Report on Sunapee Lake Town Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineer, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

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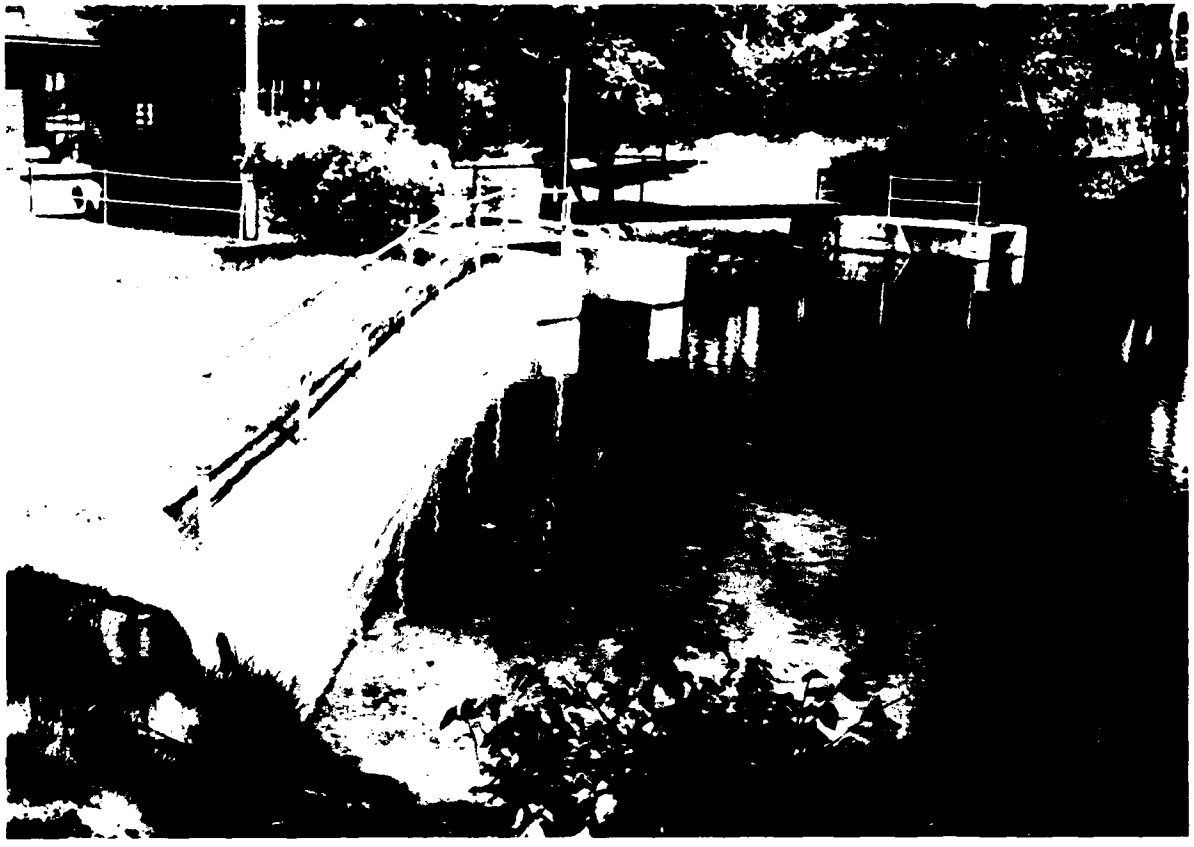
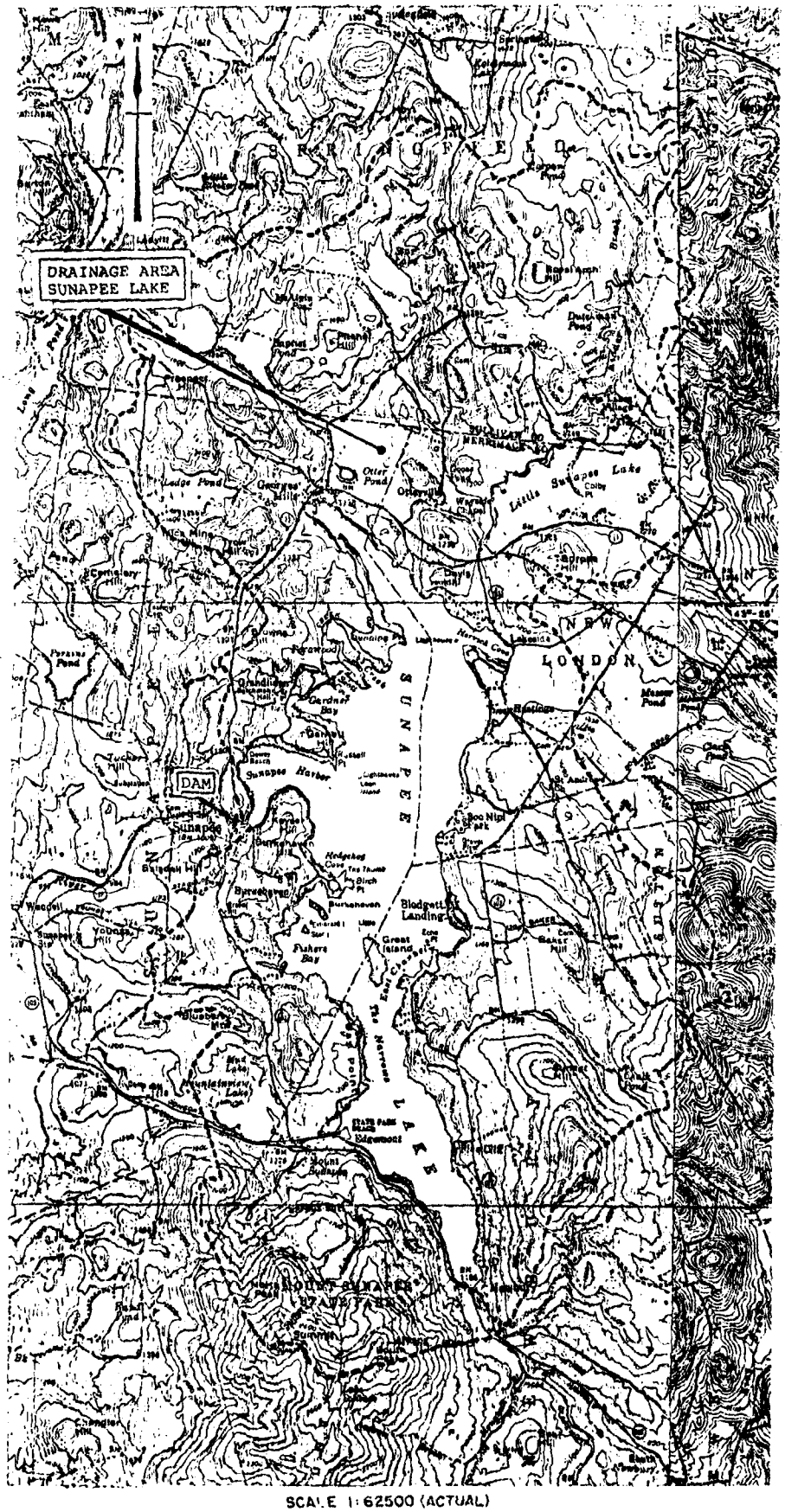
OVERVIEW PHOTOGRAPH



SUNAPEE TOWN DAM, LOOKING NORTH, DOWNSTREAM
Negative No. 5-2



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UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

NEW HAMPSHIRE
SUNAPEE QUADRANGLE 1955
AMS 6570 I-SERIES V712

MT. KEARSARGE QUADRANGLE 1:
AMS 6670 IV-SERIES V712

SUNAPEE LAKE TOWN DAM

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Fay, Spofford & Thorndike, Inc., Engineers, have been retained by the New England Division to inspect and report on selected dams in the state of New Hampshre. Authorization and notice to proceed was issued to Fay, Spofford & Thorndike, Inc., under a letter of May 3, 1978, from Mr. Ralph T. Garver, Colonel, Corps of Engineers. Contract no. DACW 33-78-C-0308 has been assigned by the Corps of Engineers for this work.

b. Purpose

(1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

(2) Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

(3) To update, verify, and complete the National Inventory of Dams.

1.2 Description of Project

a. Location

Sunapee Lake Town Dam is located in the central western part of New Hampshire in the town of Sunapee, near the old town hall. The dam is built on the headwaters of Sugar River, approximately 750 feet to the west of Sunapee Harbor. Sunapee Harbor is a small bay of Sunapee Lake located between Garnett Hill and Keyser Hill on the east shore of the lake. Sugar River flows into the Connecticut River in the city of Claremont which is about 17 miles west of Sunapee.

b. Description of Dam

The town dam consists of stone masonry, capped with concrete, and a concrete slab over the upstream face. This dam is 71 feet long with a 15-foot long north wingwall and a 53-foot long concrete south wingwall. The overall length is 139 feet. In the middle of the dam, there is a 30-foot long spillway with steel pins to support the flashboards (Photographs No. 1, 2, and 3, Appendix C).

Over the spillway, there is a footbridge spanning between two concrete abutments. The spillway is 11 feet wide and approximately 4.5 feet below the crest of the dam. The north end of the dam contains a 5-foot by 5-foot waste gate with a manually operable gate hoist. At the south abutment near the left bank, there is a 5-foot diameter, 30-foot long penstock with a manually operable gate valve, and a trash rack on the upstream side (Photographs No. 6, 7, and 9, Appendix C). This penstock feeds water to the turbine in the waterworks pumping station which is located 18 feet downstream from the dam.

It is evident from the records that this dam is founded on both hardpan and ledge, and numerous boulders were observed in the downstream channel.

Near the northwest corner of the pumping station, about 50 feet downstream from the face of the dam, there is a low 3-foot wide stone masonry sill across the pool. It creates a 4- to 5-foot waterfall and an attractive reflection pool near the roadway bridge (Photograph Nos. 10, 11, and 12, Appendix C).

Upstream from the town dam there is a regulator dam, which was built at the outlet of Sunapee Lake (Sunapee Harbor) and is called "Upper Lake Dam." This regulator dam has three gates and a telemark gage reading system connected to the New Hampshire Water Resources Board office in Concord. A fishscreen was observed on the upstream side of the regulator dam (Photograph Nos. 13, 14, and 15, Appendix C).

Between the town dam and the regulator dam is a forebay pond approximately 750 feet long with a stone masonry retaining wall at its bend (Photograph No. 16, Appendix C). The flow into this pond is controlled by the regulator dam.

c. Size Classification

The storage capacity at the spillway crest is 16,340 acre-feet, which falls in the range 1,000 and 50,000 acre-feet. Therefore, on the basis of Table 1, Size Classification, in the "Recommended Guidelines for Safety Inspection of Dams," furnished by the Corps of Engineers, the dam is classified as intermediate in size.

d. Hazard Classification

In the event of failure of this dam, residential buildings in the towns of Sunapee, Wendell, Guild, and Newport, which are downstream of the dam at distances of 1/2 mile, 2 miles, 3 miles, and 5 miles, respectively, will be in danger of being flooded. It is assumed that the height of the flood wave is two-thirds the height of the dam. On this basis, an approximate outline on U.S.G.S. Map for the damage impact area is included in Appendix D. It is estimated that in the event of failure of this dam loss of more than a few lives and excessive property damage could possibly occur. Therefore, on the basis of Table 2, Hazard Potential Classification, in the "Recommended Guidelines for Safety Inspection of Dams," furnished by the Corps of Engineers, this dam falls in the category of high hazard potential.

e. Ownership

Present owners are the town of Sunapee. In 1931, the ownership of the dam was shared between the Sunapee Dam Corporation, Brampton Woolen Co., and the town of Sunapee. The town of Sunapee and the Brampton Woolen Co. each owned 25 per cent of the dam.

Subsequently, the town of Sunapee has bought all rights to the dam in order to use the water for power for the town's waterworks pumping station.

f. Operator

Mr. Henry Cummingham, superintendant of the waterworks pumping station, Sunapee, New Hampshire, telephone (603)-763-2449.

g. Purpose of Dam

The original purpose of this dam was to store water for power to be used by the mills in the area. Since reconstruction in 1932, the dam has been used for power by the Sunapee Waterworks Pumping Station. This dam serves recreational and environmental purposes, as the lake and the upstream pond are surrounded by summer cottages and permanent houses. The downstream pool has been reconstructed to create a reflecting pool with a sill across the pool.

h. Design and Construction History

From limited available data, it appears that a dam existed in the town of Sunapee in 1856, presumably on the same site. It was referred to as the "Saw Mill Sight," or as the "Second Dam from Lake."

Due to the needs of the waterworks pumping station and because the old stone and timber dam was leaking badly, the town of Sunapee undertook a major repair in 1931. In October of that year, I. W. Jones & Co., Engineers, of Milton, New Hampshire, prepared plans and specifications for partial rebuilding and repair. The New Hampshire Public Service Commission gave its authorization to proceed with the work to the town of Sunapee's Special Water Committee on November 12, 1931.

The construction was done by Gamsby Brothers., a local contractor of Sunapee and finished in January of 1932. This contract included the following items: removal of the old wooden planking from the upstream face; replacing part of the old stone masonry; capping the upstream face and the spillway crest with concrete; installing new gates and a rack structure, and a sluice way with stop logs in the spillway; excavation of a trench; and construction of a cutoff wall along the upstream base of the stone masonry. Cofferdams were used for this construction

The spillway crest is at Elevation 1090.5, with distance below the top of the dam of 4 feet at the north abutment and 4.5 feet at the south abutment. The height of the structure above the stream bed is about 15 feet.

In 1966, the town built a sill 50 feet downstream from the dam creating a reflective pool for recreational purposes.

In 1973, the Town Dam was improved again. The abutments were to be raised by adding 1 foot at the south end and 1.5 feet at the north end, making the distance between the top of the dam and the spillway crest to be 5.5 feet. It appears that this work was never done due to the fact that field measurements indicate that this distance varies from 4 feet 3 inches to 4 feet 7 inches. A footbridge consisting of two steel stringers, wooden planking, and a steel railing along the downstream side was built over the spillway. There are sketches and some computations, made by Mr. R. C. Chamberlin, Engineer, showing the proposed modifications of the dam; but there are no as-built drawings. The field observations indicate that the sluiceway in the spillway does not exist. The spillway crest is now uninterrupted along its full length at the same height. Both gates have manually operated hoists with wheels and cranks.

i. Normal Operational Procedure

The town's water supply is conveyed to the pumping station by a 12-inch diameter main pipe from the lake. Once a week an operator from the New Hampshire Water Resources Board checks and adjusts the water level at the regulator dam. The operator who works in the Sunapee Pumping Station checks the Town Dam daily, and when necessary he adjusts the gates.

During September of every year, the Water Resources Board closes the gates at the regulator dam. At this time, the operator at Sunapee Pumping Station dewaters the forebay pond in order to perform yearly maintenance. It takes about two weeks to paint the turbine and to check the penstock and the town dam. During this time, the town's water supply is obtained from a one-million gallon storage tank which uses two pumps. For more detail, see Section 4.1.

1.3 Pertinent Data

a. Drainage Area

Although Sunapee Lake, as shown on the U.S.G.S. map, is a natural one, the water surface in the lake is controlled by the Sunapee Lake Regulator Dam, which is located about 750 feet upstream from the town dam and otherwise called the upper lake dam. It has a drainage area of 45 square miles. The watershed area is heavily wooded, undulated, and rolling.

b. Discharge at Town Dam Site

(1) Outlet works (conduits) - A 5-foot diameter penstock with an estimated invert elevation of 1083 is connected to a hydraulic turbine. The flow through the penstock drives a hydraulic turbine which, in turn, rotates a coupled centrifugal pump. There is a 5-foot by 5-foot waste sluice near the north abutment with an invert elevation of 1083. A 12-inch diameter suction pipe conveys water from Sunapee Lake to the the pumping station for Sunapee's water supply.

The estimated discharge capacities of the waste sluice are furnished below:

201 cfs when the reservoir is at Spillway Crest Elevation 1090.5.

333 cfs at maximum pool elevation 1099.2.

The estimated discharge capacities of the penstock are furnished below:

220 cfs at Elevation 1090.5, which corresponds to the spillway crest elevation.

363 cfs at Elevation 1099.2, which corresponds to the maximum pool elevation.

(2) Maximum known flood at dam site - flood of September 21-24, 1938, but the magnitude was not recorded.

(3) Ungated spillway capacity at maximum pool elevation - 9233 cfs at Elevation 1099.2.

(4) Total spillway capacity at maximum pool elevation - 9233 cfs at Elevation 1099.2.

c. Elevation (Feet above MSL)

(1) Top of dam - 1094.5 at the north abutment and 1095.0 at the south abutment.

(2) Maximum pool elevation - 1099.2.

(3) Full flood control pool - 1094.5. In the absence of pertinent data, it is assumed that the full flood control elevation coincides with the top of the dam.

(4) Recreation pool - 1090.5. It is assumed that the recreation pool elevation is the same as the spillway crest elevation.

(5) Spillway crest (ungated) - 1090.5.

(6) Stream bed at centerline of dam - 1075.5 (estimated).

(7) Maximum tail water - 1080 (estimated).

d. Reservoir

(1) Length of maximum pool - 32,000 feet (estimated).

(2) Length of recreation pool, downstream of dam, including reflection pool - 22,400 feet (estimated).

(3) Length of flood control pool - 26,000 feet (estimated).

e. Storage (Acre-Feet)

(1) Recreation pool - 16,340 acre-feet (estimated).

(2) Flood control pool - 16,160 acre-feet (estimated).

(3) Design surcharge - 16,160 acre-feet (estimated).

(4) Top of dam - 32,500 acre-feet (estimated).

f. Reservoir Surface (Acres)

(1) Top of dam - 4500 acres (estimated).

(2) Maximum pool - 4500 acres (estimated).

(3) Flood control pool - 4500 acres (estimated).

(4) Recreation pool - 4085 acres. It is assumed that the recreation pool elevation is the same as the spillway crest elevation.

(5) Spillway crest - 4085 acres. This value is obtained from planimetering the lake area on the U.S.G.S Map.

g. Dam

(1)	Type	Dry rubble masonry
(2)	Length	Approximately 71 feet
(3)	Height	15 feet
(4)	Top width	Minimum 5.75 feet, maximum 14.5 feet
(5)	Side slopes	
	(a) Upstream	Approximately 1 vertical to 1 horizontal
	(b) Downstream	Vertical
(6)	Zoning	Not applicable
(7)	Impervious core	Not applicable

(8)	Cutoff	Upstream face of dam concrete masonry with the possibility of sheet piling
(9)	Grout curtain	None
h.	Spillway	
(1)	Type	Ungated concrete weir
(2)	Length of weir	30 feet
(3)	Crest elevation	1090.5 msl
(4)	Gates	None
(5)	U/S channel	Forebay pond (Sugar River)
i.	Regulating Outlet	
(1)	Invert	1083 (estimated)
(2)	Size	60-inch diameter
(3)	Description	Steel penstock
(4)	Control mechanism	One gate valve, manually operated
(5)	Others	
(a)	Invert	1083 (estimated)
(b)	Size	5 feet by 5 feet
(c)	Description	Concrete waste gate opening
(d)	Control mechanism	One gate, manually operated

SECTION 2 - ENGINEERING DATA

2.1 Design

a. General Project Data

As-built drawings indicating plans, elevations, and sections of the dam and appurtenant structures, including the details of the discharge facilities, such as outlet works, limit service, emergency spillways, flashboards, fuse plugs, and operation equipment, are not available from project records.

2.2 Construction

a. Concrete Properties

(1) In 1932, the materials were supplied by a local contractor, Gamsby Brothers. of Sunapee, New Hampshire.

(2) It is evident that in 1932, a specified concrete mix design was used, and tests were performed.

b. Construction History

(1) The diversion scheme, construction sequence, pertinent construction problems, and maintenance repair is not available from project records.

(2) This dam has been modified and altered since its original construction. Available project records indicate that major repairs to this dam were completed in 1932.

c. Testing

(1) Construction control test data are not available from project records.

2.3 Operation

No engineering operational data was disclosed. Normal operational procedures are described in Section 1.2.i.

The record of continuous water surface levels in Sunapee Lake, as telemetered by the gage at the outlet of the Sunapee Lake, is maintained by the Water Resources Board of the State of New Hampshire.

Information pertaining to the history of previous failures or deficiencies is presented in Section 1. In 1973, repairs to the dam were made. A footbridge with a handrail had been constructed over the dam and the sluice in the spillway dam was closed.

2.4 Evaluation

a. Availability

Except for the limited data previously mentioned, pertinent structural, geotechnical, hydrologic, and hydraulic data, which formed the basis of the design of the dam, are not available from the project records.

b. Adequacy

Sufficient engineering data are available for a Phase I inspection.

Profiles and cross sections of this dam were found in the project files. These were prepared for an inspection report and not for construction purposes.

c. Validity

The available engineering data is considered valid on the basis of the results of the visual inspection.

SECTION 3 - VISUAL INSPECTION

3.1 Findings

a. General

The Phase I inspection of Sunapee Lake Town Dam was performed on June 6, 1978. A copy of the inspection check list is included in Appendix A.

In general, the soil features are in good condition. The concrete was observed to be in good condition except for the north abutment and spillway, see subparagraph c.

b. Dam

No evidence of vertical or horizontal misalignment was observed. There is no indication of sloughing, bulging, or movement of the slopes, nor is there any evidence of seepage or piping.

A 1-foot section of the soil adjacent to the north abutment has dropped a maximum of 12 inches. This area is approximately 4 feet from the downstream edge of the dam. Observations indicated that this was probably caused by erosion (Photograph No. 8, Appendix C).

c. Appurtenant Structures

The wooden footbridge over the spillway and the concrete wingwall at the southern end of the dam is in good condition. The railing for the footbridge is generally in good condition. One vertical member located at the northern end of the dam was observed to be missing (Photograph No. 8, Appendix C). The spillway capped with concrete shows areas of erosion (Photograph No. 4, Appendix C). Concrete above the water level was observed to be in good condition except for the southern end of the north abutment where erosion was noticed. Both horizontal and vertical cracks were observed in the concrete cap of the north abutment (Photographs No. 5 and 9, Appendix C). The waste sluice gate and the penstock gate valve are both in working condition.

d. Reservoir Area

Sunapee Lake Town Dam is built on the headwaters of the Sugar River and is located in the town of Sunapee. The forebay behind the dam is small and its area is about 1/2 acre. The actual storage reservoir for Sunapee Lake Town Dam forebay is Sunapee Lake. The

storage area of Sunapee Lake is 4,085 acres. The shoreline is lined with a large number of trees. There are many cottages around the lake.

The discharge of Sunapee Lake flows through a regulator dam with a town road over it and into a forebay behind Sunapee Lake Town Dam. On both sides of the forebay, retaining walls were observed. The shoreline of the forebay is in good condition.

e. Downstream Channel

The downstream channel and side slopes are in good condition. Several large boulders were observed in the channel, and the slopes in some places are protected with dry rubble masonry. The downstream channel is deep and considerably wide only immediately downstream of the dam. At a distance of about 150 feet downstream of the dam, water flows under a roadway bridge and through a stone-lined channel. There is an abandoned dam approximately 475 feet downstream from the town dam.

Even though the channel immediately downstream of the dam has enough conveying capacity to handle flood flows within its banks, the downstream channel in the vicinity of the damage impact areas does not. This would result in flooding, and consequently damaging property and perhaps loss of life.

3.2 Evaluation

The observed condition of the dam is good. The potential problems observed during the visual inspection are listed as follows:

a. Concrete erosion.

b. Potential for overtopping.

c. Settlement of the area adjacent to the north abutment.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 Procedures

The Town of Sunapee has operated Sunapee Lake Town Dam since about 1931. The water level of the forebay pond is maintained by a spillway located at the center of the dam. The flow is controlled by manually operated flashboards. Drawdown is accomplished by opening the waste sluice and the steel penstock. The waste sluice is controlled by a gate and the penstock by a gate valve, both manually operated.

4.2 Maintenance of Dam

The maintenance of Sunapee Lake Town Dam is the responsibility of the town of Sunapee.

4.3 Maintenance of Operating Facilities

The dam is inspected daily by the operator who works in the Sunapee Pumping Station. Maintenance of the operating facilities that regulate the intake gate valve, which controls the flow into the 5-foot diameter pehstock, and the waste sluice gate opening is satisfactory.

4.4 Description of any Warning System in Effect

A flood warning system is in effect. There is a telemetered stream gage at the outlet of Sunapee Lake and it is maintained and monitored by the New Hampshire Water Resources Board. During floods, as soon as the water level in Sunapee Lake exceeds the permissible limit, the three gates of the regularoty dam outlet will be fully opened with instructions to the town of Sunapee to open the waste sluice gate in the body of the town dam.

4.5 Evaluation

The operation and maintenance procedures for Sunapee Lake Town Dam consisting of daily inspection, should ensure that all problems encountered can be remedied within a reasonable period of time.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data

(1) This dam fall under the category of high hazard potential and it is intermediate in size. Using the "Recommended Guidelines for Safety Inspection of Dams," the recommended spillway test flood peak inflow is equal to the probable maximum flood. The spillway test flood inflow hydrograph, estimated, is furnished in Appendix D. The spillway test flood peak inflow is 65,250 cfs.

(2) The estimated maximum peak outflow corresponding to the spillway test flood inflow is about 9,233 cfs. Refer to Appendix D for details.

(3) The lake storage capacity versus the elevation, an estimated capacity curve is included in Appendix D.

(4) The estimated composite discharge rating curve for the spillway and all discharge facilities is furnished in Appendix D.

(5) The hydrologic map of the watershed above the dam site, including reservoir area, water course, deviation contours, and principal stream flow is included in Appendix D.

b. Experience Data

Except for very limited information, details of past floods are not available for this dam. Rainfall records for the area are available for the years 1892 to 1941. It is noted that significant monthly rainfalls were recorded in September, 1938, and March, 1936. Rainfall recorded in the month of September, 1938, was 12.43 inches, which was more than 3.5 times the monthly average rainfall. The flood of September 21-24 is considered to be the maximum flood that has occurred. On the basis of regional frequency studies, the flood of 1938 corresponds to a 100-year flood. The maximum height of water over the permanent crest of the spillway was not measured.

c. Visual Observations

The crest of the non-overflow section of the south side of the dam is 4 feet above the crest of the spillway. The corresponding dimension of the north side is 4.5 feet. The hydraulic design of the spillway is poor, and there are no energy dissipation works below the spillway. Water is allowed to fall freely on the channel bed downstream of the spillway. The stream bed is lined with boulders.

d. Overtopping Potential

Sunapee Lake has a very large surface area (4,500± acres) and flood runoff from the watershed goes more into surcharge storage then into spillway discharge. With a full probable maximum test flood (PMF) runoff of 19 inches with an estimated peak inflow of 65,000 cfs, the outflow would be reduced to about 9,000 cfs, with about 16 inches of runoff going into surcharge storage. Such a flood would cause about an 8.7-foot rise in lake level, overtopping the dam by about 4.2 feet. A flood one-half the PMF, with 9.5 inches of runoff and a peak inflow of 32,000 cfs would result in a spillway outflow of about 1,700 cfs with about 9 inches of the flood runoff going into surcharge storage. This flood would cause a 4.8-foot rise in the lake level resulting in only about 0.3 foot overtopping of the dam. Spillway capacity with pool at top of dam is about 1,600 cfs.

SECTION 6 - STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

The upstream slope could not be seen due to the fact that it was under water. The visual inspection revealed no evidence of stability problem except possibly for the settlement area adjacent to the north abutment

Erosion of the spillway and the erosion and minor cracks at the north abutment does not pose an immediate stability problem but could lead to future problems if it is not repaired.

b. Design and Construction Data

There are no construction drawings or structural computations. There are a few free-hand sketches, dated 1937, which were prepared by the inspecting engineer, showing basic dimensions of the dam. Some computations and sketches made prior to the repairs in 1973, are available.

c. Operating Records

Except for memorandums and correspondence listed in Appendix B, other operating records were not available at the office of the New Hampshire Water Resources Board. There are additional records at the town of Sunapee pumping station.

d. Post-Construction Changes

The routine repairs that are recorded in the files were done in 1973. These repairs consisted of new concrete piers on the upstream side and repairing the gates in the dam. The structural stability was not affected by these repairs.

e. Seismic Stability

The dam is located in Seismic Zone 2 and in accordance with recommended Phase I guidelines does not warrant seismic analyses.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS, & REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

The visual inspection and operational history indicates that Sunapee Lake Town Dam is in good condition and functioning satisfactorily.

b. Adequacy of Information

An adequate assessment of the dam consistent with the scope of Phase I investigation has been made based upon the visual inspection and available information.

c. Urgency

The recommendations and remedial measures enumerated in Section 7.2 and 7.3 should be implemented within 2 years of receipt of this Phase I report by the owner.

d. Need for Additional Investigation

See Section 7.2.

7.2 Recommendations

Because of the large surcharge storage feature of this project, it is recommended that more detailed hydrologic studies be performed to determine the ability of this project, through storage and spillway capacity, to withstand major flood runoff. The extent of damage that might occur at the dam and in downstream areas in the event of overtopping should be assessed.

7.3 Remedial Measures

It is considered important that the following operating and maintenance procedures be attended to as early as practical:

a. Proper grade of the settled area adjacent to the north abutment should be reestablished and a missing rail post installed.

b. All damaged or eroded concrete surfaces should be repaired as continued deterioration could develop into a serious problem.

c. A program of regular maintenance should be established.

d. A program of technical biannual periodic inspection of the project features should be prepared and initiated.

e. Because the dam is located upstream of a populated area, round-the-clock surveillance should be provided during periods of high precipitation.

f. The owner should develop a formal warning system. An operational procedure to follow in event of an emergency should also be adopted.

7.4 Alternatives

None recommended.

APPENDIX A

VISUAL INSPECTION CHECK LISTS

APPENDIX A

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT Sunapee Lake Town Dam DATE June 6, 1978

TIME 1000-1530

WEATHER Sunny

W.S. ELEV. 1092.5 U.S. _____ DN.S.

PARTY:

1.	Jurgis Gimbutas, P.E.	Team Captain - Structural and Concrete
2.	Harvey H. Stoller, P.E.	Soils, Geology and Foundation
3.	V. Rao Maddineni, P.E.	Hydraulics and Hydrology

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	Dam Embankment	H. H. Stoller	Good
2.	Outlet Works - Waste Gate Outlet	J. Gimbutas	Fair
3.	Outlet Works - Penstock	J. Gimbutas	Good
4.	Spillway Weir	J. Gimbutas	Fair
5.	Approach and Discharge Channels	V. R. Maddineni H. H. Stoller	Good
6.	Pond and Downstream Channel	V. R. Maddineni	Good

PERIODIC INSPECTION CHECK LIST

PROJECT Sunapee Lake Town Dam DATE June 6, 1978

PROJECT FEATURE Dam Embankment

DISCIPLINE Soils & Foundations NAME

PROJECT FEATURE

DISCIPLINE NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	1094.8 msl (North Abutment) 1095.1 msl (South Abutment)
Current Pool Elevation	1092.5 msl
Maximum Impoundment to Date	1094.5 msl
Surface Cracks	Minor crack in concrete cap of North Abutment
Pavement Condition	None
Movement or Settlement of Crest	None observed
Lateral Movement	None observed
Vertical Alignment	No visual vertical misalignment observed
Horizontal Alignment	No visual horizontal misalignment observed

PERIODIC INSPECTION CHECK LIST

PROJECT Sunapee Lake Town Dam DATE June 6, 1978

PROJECT FEATURE Dam Embankment

DISCIPLINE Soils & Foundations NAME

PROJECT FEATURE

DISCIPLINE NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
Condition at Abutment and at Concrete Structures	Erosion observed at southern end of North Abutment
Indications of Movement of Structural Items on Slopes	None observed
Trespassing on Slopes	None observed
Sloughing or Erosion of Slopes or Abutments	None observed
Rock Slope Protection - Riprap Failures	None
Unusual Movement or Cracking at or Near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	None

PERIODIC INSPECTION CHECK LIST

PROJECT Sunapee Lake Town Dam DATE June 6, 1978

PROJECT FEATURE Dam Embankment

DISCIPLINE Soils and Foundations NAME Henry H Stelle

PROJECT FEATURE _____

DISCIPLINE _____ NAME _____

DISCIPLINE _____ NAME _____

AREA EVALUATED	CONDITION
Toe Drains	None
Instrumentation System	None

PERIODIC INSPECTION CHECK LIST

PROJECT Sunapee Lake Town Dam DATE June 6, 1978

PROJECT FEATURE Outlet Works

DISCIPLINE Structural & Concrete NAME

PROJECT FEATURE

DISCIPLINE NAME

DISCIPLINE NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - WASTE GATE OUTLET	
General Condition of Concrete	Fair condition
Erosion or Cavitation	None observed
Condition at Joints	Good
Gates	One, manually operated
OUTLET WORKS - PENSTOCK	
Size	60-inch diameter steel pipe
General Condition	Could not be observed
Gate Valve	One, manually operated

PERIODIC INSPECTION CHECK LIST

PROJECT Sunapee Lake Town Dam DATE June 6, 1978

PROJECT FEATURE Spillway Weir

DISCIPLINE Structural & Concrete NAME

PROJECT FEATURE Channels

DISCIPLINE Hydraulics & Hydrology NAME

DISCIPLINE Soils & Foundations NAME

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Good condition
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	None observed
Floor of Approach Channel	Could not be observed
b. Weir and Retaining Walls	
General Condition of Concrete	Fair
Rust or Staining	None observed
Spalling and Cracking of Concrete	Little at North Abutment

PERIODIC INSPECTION CHECK LIST

PROJECT Sunapee Lake Town Dam DATE June 6, 1978

PROJECT FEATURE Spillway Weir

DISCIPLINE Structural & Concrete NAME

PROJECT FEATURE Channels

DISCIPLINE Hydraulics & Hydrology NAME

DISCIPLINE Soils & Foundations NAME

AREA EVALUATED	CONDITION
Any Visible Reinforcing	None observed
Any Seepage or Efflorescence	None observed
Drain Holes	None
c. Discharge Channel	
General Condition	Good condition
Loose Rock Overhanging Channel	None observed
Trees Overhanging Channel	None observed
Floor of Channel	Good condition
Other Obstructions	None observed

APPENDIX B

EXISTING AVAILABLE INFORMATION

APPENDIX B

1. Listing of Design, Construction and Maintenance Records

Filed at New Hampshire Water Resources Board in Concord, New Hampshire under Town/Dam No. 229.05:

(1) Photograph dated October 7, 1931, showing the dam prior to the 1932 reconstruction. The old wooden saw mill was still on the north bank of the river, and the present town hall in the background.

(2) October 5, 1931. Gamsby Brothers' (contractors) letter proposing to do the rebuilding of the dam. There are handwritten notes of years 1856, 1857, 1860 and later, indicating that this dam is at least that old.

(3) October 8, 1931. Questionnaire - dam information, written by the chairman, Special Water Committee, town of Sunapee, received by New Hampshire Public Service Commission. This document describes the intended rebuilding to be done.

(4) October 27, 1931. Specifications for Rebuilding Dam for Village of Sunapee, New Hampshire, by I. W. Jones & Co., Engineers, Milton, New Hampshire. This 14-page typewritten document includes 2 pages of the contract proposed, not signed. With these specifications, plans were furnished as follows: Sheet A - Survey of Existing Conditions; Sheet B - Plan, Elevation and Sections, showing the proposed reconstruction of the dam and gates; Sheet C - Details of Miscellaneous Ironwork.

Note: None of these plans could be located in the files of the New Hampshire Water Resources Board nor at the town hall in Sunapee.

(5) November 12, 1931. Authorization from the New Hampshire Public Service Commission to proceed with the reconstruction of the dam.

(6) December 5, 1931. Letter from I. W. Jones & Co., Engineers, to the Public Service Commission in Concord, New Hampshire, explaining a change of Design Sheet B showing a sluiceway 5 feet 0 inch wide in the location of the former opening which they had planned to close. Enclosed were two curve sheets, copies of which are available. One shows the

discharge capacity of the dam at various stages of the water level. The second curve sheet shows effect on Sunapee Lake of a very severe storm.

(7) January 1932. Sketch showing location of top of ledge rock under north end of dam. By Mr. E. L. Grimes, Sunapee, New Hampshire. Apparently he was the contractor's representative.

(8) February 2, 1932. Report of test of cement by the Thompson & Lichtner Co., Inc., Boston, Massachusetts.

(9) July 10, 1942. A questionnaire from the New Hampshire Water Resources Board, filled out by Mr. M. G. Chase, Selectman of the town of Sunapee, stating the good condition of the dam and the power plant (water supply pump) in operation.

(10) April 16, 1965. Discharge measurement notes on Sunapee River (Sugar River) 500± feet below the upper dam.

(11) 1973. Unfinished plan showing three sluice gates for the lake level control dam on the Sunapee Lake outlet, by New Hampshire Water Resources Board, Concord, New Hampshire, and a cost estimate dated February 27, 1973.

(12) February - May 1973. Several letters and sketches by Mr. Robert B. Chamberlin discussing proposed remodeling of the dam. This would have included raising the abutments, date controls and side walls, construction of a footbridge, and installation of electric gate operators with motors at both stems.

2. Copies of Past Inspection Reports

(1) September 17, 1937. Inventory of dams, by New Hampshire Water Resources Board. Includes freehand sketches with dimensions.

(2) September 12, 1939. Data on dams, by New Hampshire Water Resources Board. Tabulated by RLT.

NEW HAMPSHIRE WATER RESOURCES BOARD

INVENTORY OF DAMS AND WATER POWER DEVELOPMENTS

DAM

BASIN *Connecticut* NO. *5 229.05*
RIVER *Sugar* MILES FROM MOUTH [illegible] D.A.SQ.MI [illegible]
TOWN *Sunapee* OWNER *Town of Sunapee*
LOCAL NAME OF DAM
BUILT *1932* [illegible] DESCRIPTION [illegible]
[illegible] [illegible]
[illegible]
POND AREA-ACRES DRAWDOWN FT. POND CAPACITY-ACRE FT.
HEIGHT-TOP TO BED OF STREAM-FT. *8 15* MAX. MIN.
OVERALL LENGTH OF DAM-FT. *60 65* MAX.FLOOD HEIGHT ABOVE CREST-FT.
PERMANENT CREST ELEV.U.S.G.S. *1090.3* LOCAL GAGE
TAILWATER ELEV.U.S.G.S. *1080.2* LOCAL GAGE
SPILLWAY LENGTHS-FT. *20 22.5* FREEBOARD-FT. [illegible]
FLASHBOARDS-TYPE,HEIGHT ABOVE CREST *Removable* [illegible]

WASTE GATES-NO.	WIDTH	MAX.OPENING	DEPTH SILL BELOW CREST
1	*5*	*5*	*7*
1	*3.5*	*6*	*6* [illegible] *spillway*

REMARKS *Condition* [illegible] *Good*
3H.

POWER DEVELOPMENT

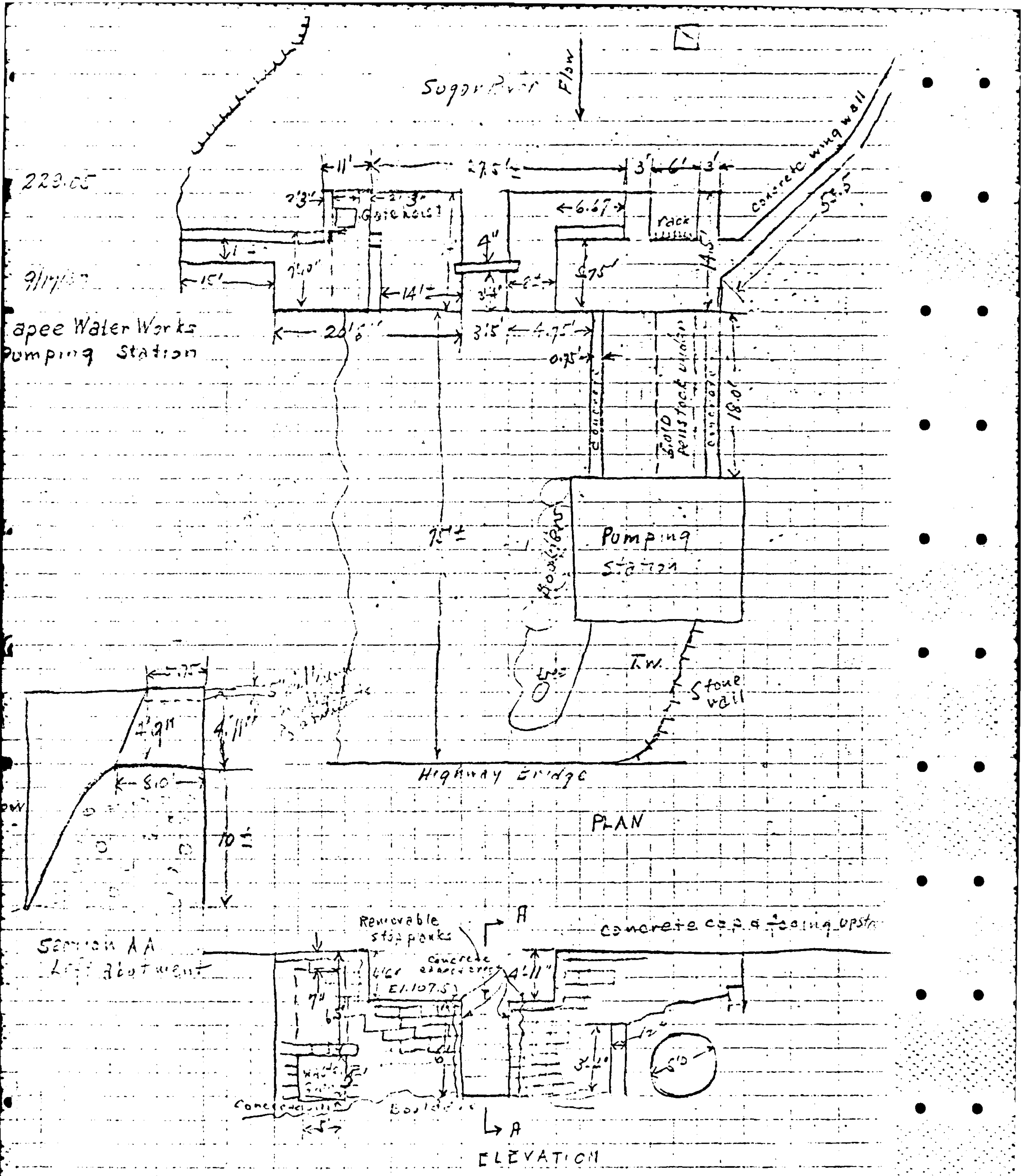
UNITS NO.	RATED HP	HEAD FEET	C.F.S. FULL GATE	KW	MAKE
1	*48*	*10.*			[illegible]
					[illegible]
					[illegible]
					[illegible]

USE *Pumping Station for town water supply*

REMARKS *Information from* [illegible] *Water Commissioner*
Dam built by [illegible] *Construction Co.* *5' dia.* [illegible] *30'* [illegible]

DATE *1975* [illegible]
[illegible]

N


Flow
223.05
9/17/...
apee Water Works
Pumping Station
Gatehoist
rack
concrete wing wall
Pumping Station
Boulders
T.W.
Stone wall
Highway Bridge
PLAN
Removable stop planks
concrete cap & facing upstr
Section AA
Left Abutment
El. 107.5
Boulders
ELEVATION

NEW HAMPSHIRE WATER CONTROL COMMISSION
DATA ON DAMS IN NEW HAMPSHIRE

LOCATION STATE NO. 229.05

Town Sunapee : County Sullivan

Stream Sugar River

Basin-Primary Conn. R. : Secondary Sugar R.

Local Name

Coordinates—Lat. : Long.

GENERAL DATA

Drainage area: Controlled Sq. Mi.: Uncontrolled Sq. Mi.: Total 45 Sq. Mi.

Overall length of dam 65 ft.: Date of Construction 1932 replaced timber

Height: Stream bed to highest elev. 15 ft.: Max. Structure 10'6" ft.

Cost—Dam : Reservoir

DESCRIPTION Masonry wall-stone&concrete

Waste Gates

Type

Number 2 : Size 5, 6 ft. high x 1-5, 1-3.5 ft. wide

Elevation Invert 7, 6 : Total Area sq. ft.

Hoist Wheel

Waste Gates Conduit

Number : Materials

Size ft.: Length ft.: Area sq. ft.

Embankment

Type

Height—Max. ft.: Min. ft.

Top—Width : Elev. ft.

Slopes—Upstream on: Downstream on

Length—Right of Spillway : Left of Spillway

Spillway (sluice in center of spillway)

Materials of Construction masonry

Length—Total 27.5 ft.: Net ft.

Height of permanent section—Max. 10.5 ft.: Min. 10' ft.

Flashboards—Type removable stop planks in sluiceway Height ft.

Elevation—Permanent Crest 1090.3 : Top of Flashboard

Flood Capacity cfs.: cfs/sq. mi.

Abutments

Materials:

Freeboard: Max. 4'6" ft.: Min. ft.

Headworks to Power Devel.—(See "Data on Power Development")

OWNER Town of Sunapee

REMARKS Use-Public Utilities, Pumping station for town water Supply.

Condition good

Tabulation By RLT Date 9/12/39

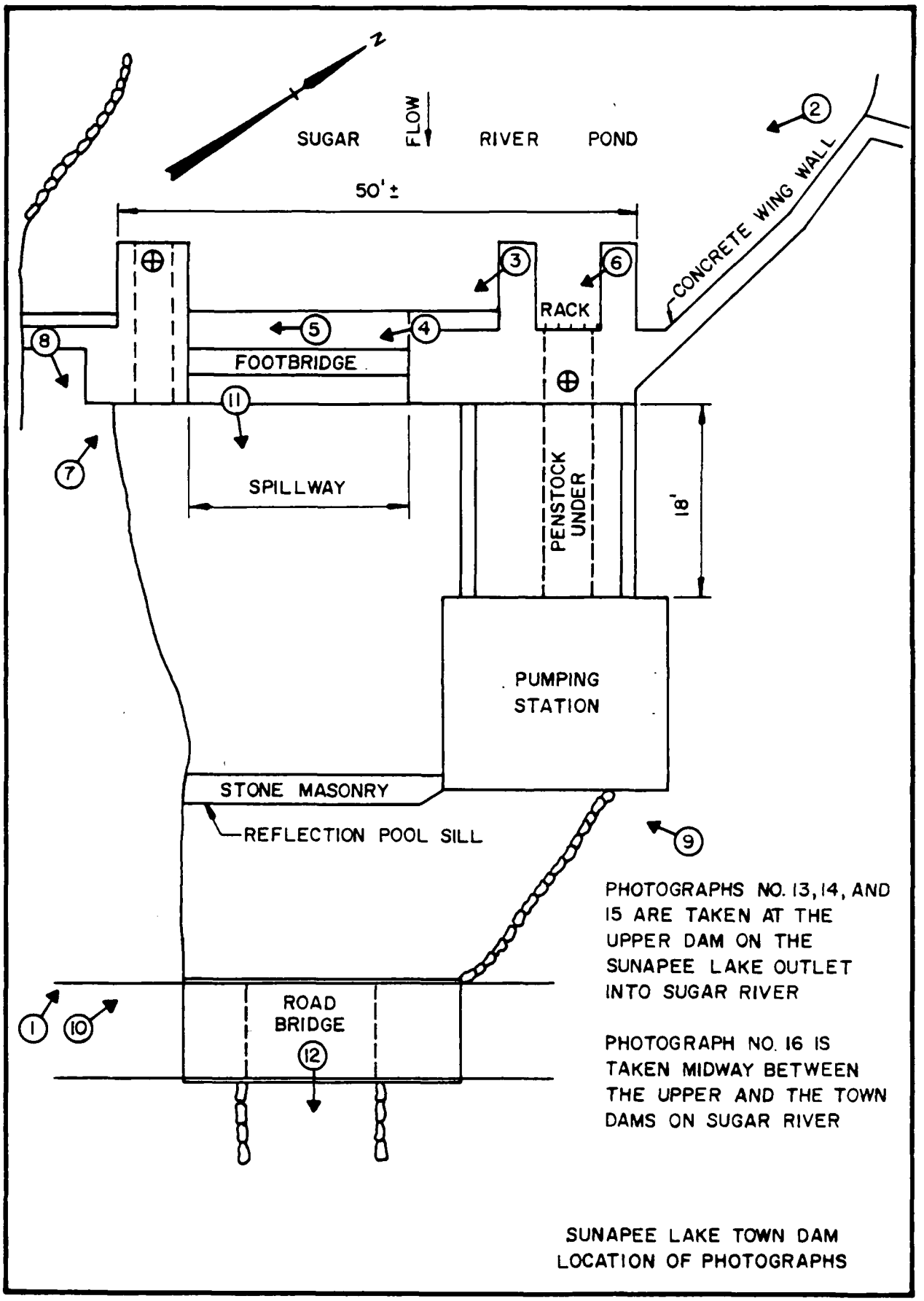
APPENDIX C

PHOTOGRAPHS

APPENDIX C

REPRESENTATIVE PHOTOGRAPHS OF PROJECT

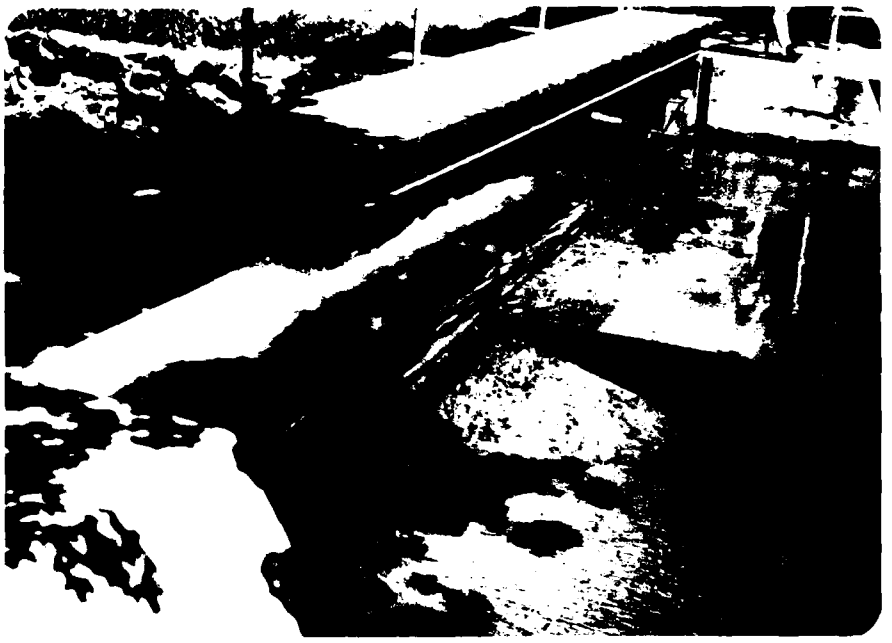
No.		Negative No.	Page
12.	Downstream channel looking west from the bridge.	5-12	C-9
13.	Gate operating stems at the "Upper Lake Dam."	5-22	C-10
14.	"Upper Lake Dam" looking upstream.	5-21	C-10
15.	Fish screens at the "Upper Lake Dam," looking downstream	8-30A	C-11
16.	Sugar River bank protection at the bend midway between the "Upper Lake Dam" and the Town Dam, looking south.	8-29A	C-11

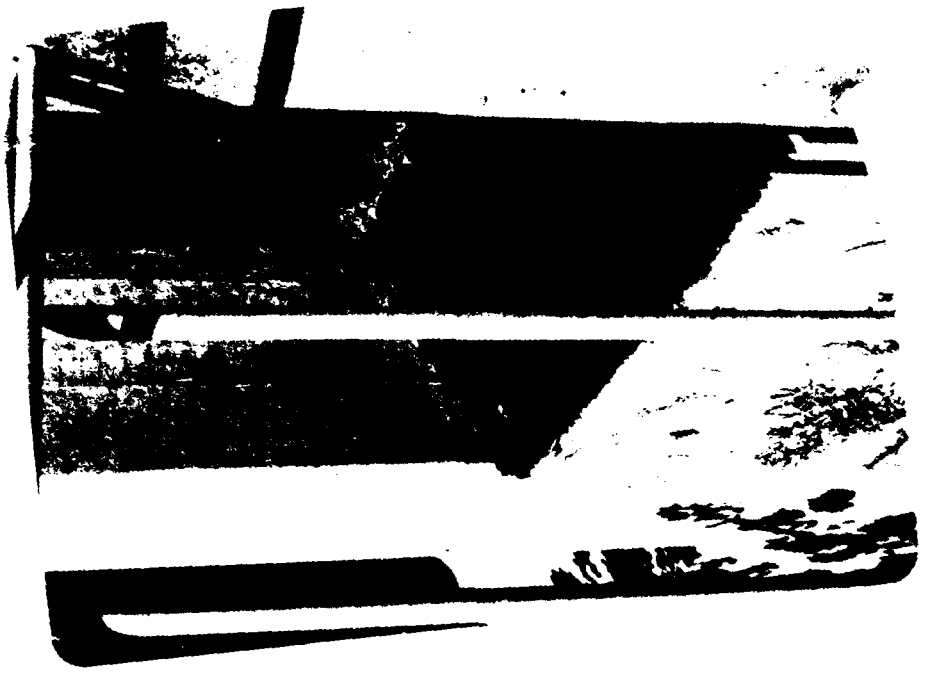


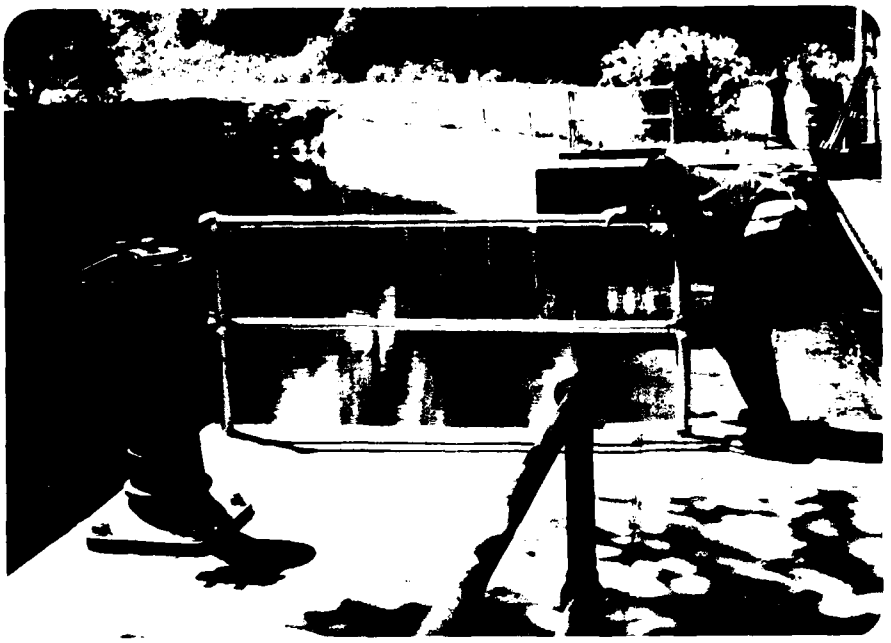
PHOTOGRAPHS NO. 13, 14, AND 15 ARE TAKEN AT THE UPPER DAM ON THE SUNAPEE LAKE OUTLET INTO SUGAR RIVER

PHOTOGRAPH NO. 16 IS TAKEN MIDWAY BETWEEN THE UPPER AND THE TOWN DAMS ON SUGAR RIVER

SUNAPEE LAKE TOWN DAM
LOCATION OF PHOTOGRAPHS



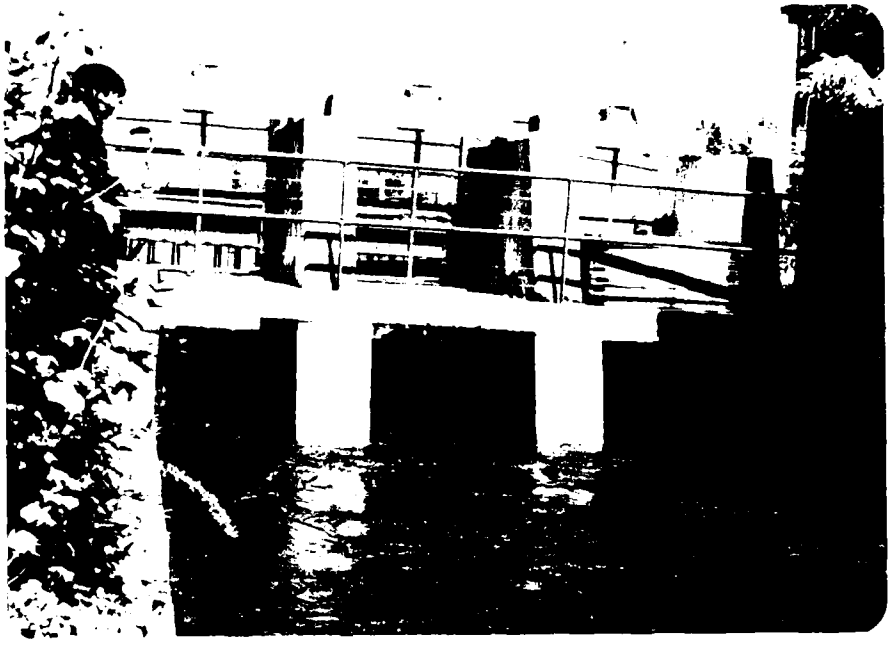


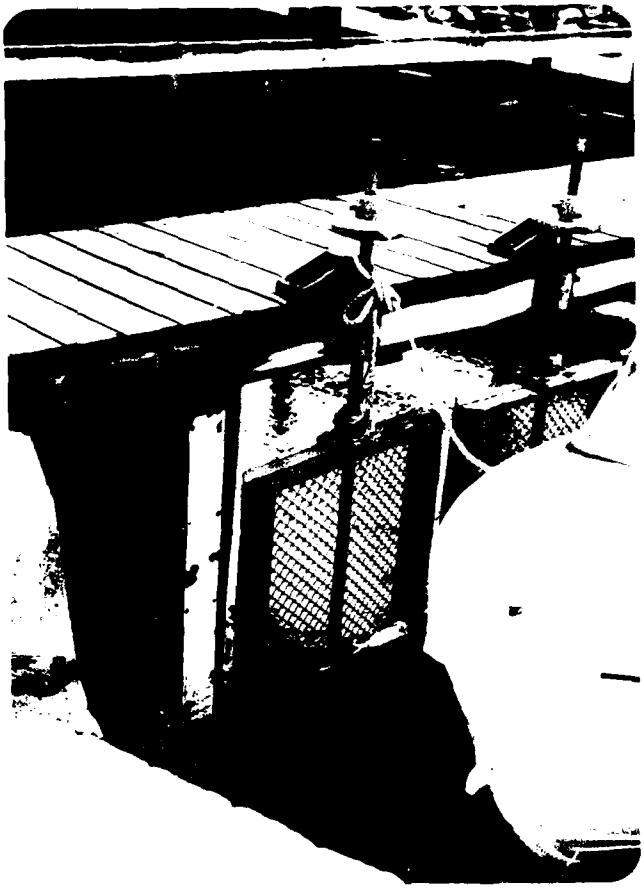


d. Downstream Channel and Bridge Looking From the Town Dam.

e. Downstream Channel, Looking West From the Bridge.


SUNAPEE
LAKE
N.H. Water Resources Board
Help Us to keep this DAM Clean!





15. Fish Screens at the "Upper Lake Dam," Looking Downstream.

16. Sugar River Bank Protection at the Bend Midway Between the Upper and the Town Dams, Looking South.

APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS

APPENDIX - D

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT I.N.E. DAMS

FILE NUMBER
SHEET NUMBER
DATE
COMPUTED BY
CHECKED BY

SUBJECT LINE ITEM 7: SUNAPEE TOWN DAM

ESTIMATING EFFECT OF [illegible] ON MAXIMUM SPILLWAY DISCHARGE

Total drainage area of Sunapee Lake = [illegible]

The drainage area of Sunapee Lake is characterized by mountainous topography.

From guide curves furnished by the Corps. of Engineers, It is found that:

$$\text{Probable Maximum}^{\text{INFLOW}}_{\text{Flood Peak}} = 1{,}450 \times 45$$

$$Q_{P_1} = 65{,}250.0 \text{ CFS}$$

According to size classification, Sunapee Town Dam is intermediate.

According to hazard classification, it falls under the category of high hazard dam.

∴ SPILLWAY TEST FLOOD PEAK INFLOW

= 65,250.0 C.F.S.

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EN-006 (7)

FILE NUMBER E-1-
SHEET NUMBER 2 2 =
DATE 2 - 3
COMPUTED BY M.
CHECKED BY

SUBJECT SUNAPEE TOWN DAM
SPILLWAY TEST INFLOW FLOOD HYDRO-GRAPH

SUNAPEE LAKE

1. Length of travel from farthest point to Sunapee Lake ≈ 37,800'

Length of travel through lake to outlet ≈ 22,400'

Total travel from farthest point to outlet = 60,200'

2. Elev. of farthest point = 1900
ELEV. @ Outlet = 1100
Difference = 800'

FAY, SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-006 (2)

FILE NUMBER EN-006.1
SHEET NUMBER 3 OF
DATE 7-1-78
COMPUTED BY JEM
CHECKED BY

SUBJECT SUNAPEE TOWN DAM

SPILLWAY TEST INFLOW FLOOD HYDROGRAPH
(BASED ON SCS DIMENSIONLESS UNIT HYDROGRAPH)

Max. length of travel = 60,200 feet

Difference in Elevation = 800 feet

$$t_c = \frac{(60,200)^{1.15}}{7700 \times (800)^{0.38}} \text{ hrs.}$$

$$= \frac{3137157.49}{7700 \times 12.68}$$

$$= 3.213 \text{ hrs.}$$

Spillway test inflow flood peak = 65,250 cfs.

FAY, SPOFFORD & THORNDIKE, INC
ENGINEERS
BOSTON

PROJECT EN-CCL (7)

FILE NUMBER [illegible]
SHEET NUMBER [illegible]
DATE [illegible]
COMPUTED BY EM
CHECKED BY

SUBJECT SUNAPEE TOWN DAM

SPILLWAY TEST INFLOW FLOOD HYDROGRAPH
(BASED ON SCS DIMENSIONLESS UNIT HYDROGRAPH)

$T_c = 3.25$ hrs.

SDF = 65,250 CFS.

T (hrs)	T/Tc	Q/Qp	Q (CFS)
0.81	0.25	0.05	3262.5
1.625	0.50	0.18	11745.0
2.44	0.75	0.73	47632.5
3.25	1.00	1.00	65250.0
4.06	1.25	0.80	52200.0
4.875	1.50	0.40	26100.0
5.69	1.75	0.25	16312.5
6.50	2.00	0.17	11092.5
8.94	2.75	0.06	3915.0
11.375	3.50	0.02	1305.0
13.00	4.00	0.01	652.5

BOSTON

SHEET NUMBER 2

SUBJECT SWIFT TOWN DAM

DATE 2-2-72

COMPUTED BY [illegible]

CHECKED BY

DISCHARGE RATING TABLE FOR WASTE SLUICE

WASTE SLUICE = 5' x 5'.

A = 25.0 ft²

INVERT ELEVATION = 1083.0

$Q = C_d \cdot A \cdot \sqrt{2gy}$; $C_d = 0.45$

$= 90\sqrt{y}$

ELE.	y	Q_s
1090.5	5.0	201.0
1091.5	6.0	220.0
1092.5	7.0	238.0
1093.5	8.0	255.0
1094.5	9.0	270.0
1095.5	10.0	285.0
1096.5	11.0	299.0
1097.5	12.0	312.0
1098.5	13.0	325.0
1099.5	14.0	337.0
1101.5	15.0	349.0
1102.5	17.0	371.0
1105.5	20.0	403.0
1110.5	25.0	450.0
1115.5	30.0	493.0
1120.5	35.0	532.0
1126.2	40.7	574.0

D 5

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EN-006 (7)

FILE NUMBER EN-006
SHEET NUMBER 6
DATE 2-21-1978
COMPUTED BY [illegible]
CHECKED BY

SUBJECT LILLIAPEE TOWN DAM

DISCHARGE RATING TABLE FOR 5' DIA. PENSTOCK

Take approximately the invert elevation of penstock = 1083.00

Elevation of the center of Penstock = 1085.5.

$$Q = C_d \cdot A \cdot \sqrt{2gh} = 0.625 \times \frac{\pi}{4} \times 25 \times 8 \times \sqrt{h}$$

$$= 98.175 \sqrt{h}$$

ELE.	h	Q_p
1090.5	5'	219.526 ≈ 220.0
1091.5'	6.	240.478 ≈ 241.0
1092.5	7	259.746 ≈ 260.0
1093.5'	8	277.680 ≈ 278.0
1094.5'	9	294.525 ≈ 295.0
1095.5'	10	310.456 ≈ 310.0
1096.5'	11	325.609 ≈ 326.0
1097.5'	12	340.068 ≈ 340.0
1098.5'	13	353.975' ≈ 354.0
1099.5'	14	367.337 ≈ 367.0
1100.5'	15'	380.180 ≈ 380.0
1102.5'	17	404.785' ≈ 405.0
1105.5'	20	439.051 ≈ 439.0
1110.5'	25'	490.875' ≈ 491.0
1115.5'	30	537.726 ≈ 538.0
1120.5'	35'	580.211 ≈ 581.0
1126.2	40.7	626.[illegible] ≈ 626.0

ENGINEERS BOSTON

PROJECT [illegible]

SHEET NUMBER 7

DATE 6-4-1976

SUBJECT SUNAPEE TWIN DAM

COMPUTED BY JEM

CHECKED BY

DISCHARGE RATING TABLE FOR SPILLWAY + DAM + OVERBANKS

Length of spillway = 30 feet

Length of Dam = 41 feet

Length of overbanks = 270 − 71 = 199 feet.

$(H_s)_1 = 1.0$ $\quad (Q_s)_1 = 90.0$ cfs

$(H_s)_2 = 2.0$ $\quad (Q_s)_2 = 255.0$ "

$(H_s)_3 = 3.0$ $\quad (Q_s)_3 = 468.0$ "

$(H_s)_4 = 4.0$ $\quad (Q_s)_4 = 720.0$ "

$(H_s)_5 = 5.0$ $\quad (H_D) = 0.5$

$\therefore Q = 3 \times 30 \times (5)^{3/2} + 2.6 \times 41 \times (0.5)^{3/2}$

$= 1006.23 + 37.688 \quad = 1043.9$ cfs.

$(H_s)_6 = 6.0$ $\quad Q = 3 \times 30 \times (6)^{3/2} + 2.6 \times 41 \times (1.5)^{3/2}$

$= 1322.72 + 195.836 \quad = 1518.6$ "

$(H_s)_7 = 7.0$ $\quad Q = 3 \times 30 \times (7)^{3/2} + 2.6 \times 41 \times (2.5)^{3/2} + 2.6 \times 199 \times (1)^{3/2}$

$= 1667 + 421 + 517.0$

$= 2088$ cfs. $\quad = 2088$ cfs.

$(H_s) = 8.0$ $\quad Q = 3 \times 30 \times (8)^{3/2} + 2.6 \times 41 \times (3.5)^{3/2} + 2.6 \times 199 \times (2)^{3/2}$

$= 2036 + 678 + 1463$

$= 4177$ cfs.

$(H_s) = 9.0$ $\quad Q = 3 \times 30 \times (9)^{3/2} + 2.6 \times 41 \times (4.5)^{3/2} + 2.6 \times 199 \times (2)^{3/2}$

$= 2430 + 1018 + 2688 \quad = 6136$ cfs.

$(H_s) = 10.0$ $\quad Q = 3 \times 30 \times (10)^{3/2} + 2.6 \times 41 \times (5.5)^{3/2} + 2.6 \times 199 \times (4)^{3/2}$

$= 2846 + 1375 + 4137 \quad = 8358$ cfs.

FAY, SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EN-006 (7)

FILE NUMBER EN-006

SHEET NUMBER 8

DATE 6-4-77

COMPUTED BY WRM

CHECKED BY

SUBJECT SUNAPEE TOWN DAM

DISCHARGE RATING TABLE SPILLWAY + DAM + OVERBANKS

$(H_S) = 12.0$ $\quad Q = 3 \times 30 \times (12)^{3/2} + 2.6 \times 41 \times (7.5)^{3/2} + 2.6 \times 199 \times (6)^{3/2}$

$= 3741 + 2130 + 7664 \qquad = 13,535$ cfs

$(H_S) = 15.0$ $\quad Q = 3 \times 30 \times (15)^{3/2} + 2.6 \times 41 \times (10.5)^{3/2} + 2.6 \times 199 \times (9)^{3/2}$

$= 5229 + 3627 + 13,970 \qquad = 22826$ cfs

$(H_S) = 20.0$ $\quad Q = 3 \times 30 \times (20)^{3/2} + 2.6 \times 41 \times (15.5)^{3/2} + 2.6 \times 199 \times (14)^{3/2}$

$= 8050 + 6505 + 27103.0 \qquad = 41658.$

$Q_S = 3 \times 30 \times (8.7)^{3/2} = 2309.5$

$\simeq 2310.0$ cfs

FAY SPOFFORD & THORNDIKE INC
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BOSTON

PROJECT EN-[illegible] (2)

FILE NUMBER [illegible]
SHEET NUMBER 1
DATE [illegible]
COMPUTED BY [illegible]
CHECKED BY

SUBJECT SILVER LAKE TOWN DAM

DISCHARGE RATING TABLE FOR SPILLWAY + DAM + OVERBANKS + PENSTOCK + WASTE SLUICE

HEAD OVER SPILLWAY	ELEV.	FLOW IN WASTE SLUICE	FLOW IN PENSTOCK	FLOW OVER SPILLWAY + OVERBANKS	TOTAL Q CFS
0	1090.5	201	220	0	421
1	1091.5	220	241	90.0	551
2	1092.5	238	260	255.0	753
3	1093.5	255	278	468.0	1001
4	1094.5	270	295	720.0	1285
5	1095.5	285	310	1044.0	1639
6	1096.5	299	326	1519.0	2144
7	1097.5	312	340	2088.0	2740
8	1098.5	325	354	4197.0	4876
10	1100.5	349	380	8360.0	9089
15	1105.5	403	439	22826.0	23668
20	1110.5	450	491	41,658.0	42599

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PROJECT EN-006 (7)

FILE NUMBER [illegible]
SHEET NUMBER 10
DATE [illegible]
COMPUTED BY [illegible]
CHECKED BY [illegible]

SUBJECT SWANSEA TOWN DAM
ESTIMATION OF CAPACITY CURVE

Spillway crest elevation = 1090.5

Surface area of lake at elevation 1090.5
= 4085 acres

ELEVATION	STORAGE
1090.5	16,340
1091.0	18 382.5
1092.0	22 447.5
1094.0	30 637.5
1095.0	34 722.5
1096.0	38 807.5
1100.0	55 147.5
1105.0	75 572.5
1110.0	95 997.0
1120.0	1,36847.5
1125.0	1,57272.5
1130.	1,77697.5

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BOSTON

PROJECT EN-001 (7)

FILE NUMBER EN-001
SHEET NUMBER 11
DATE 10-3-1978
COMPUTED BY [illegible]M
CHECKED BY

SUBJECT SUNAPEE TOWN DAM
TO DETERMINE PEAK OUTFLOW

PEAK INFLOW (Q_{P_1}) = 65,250 cfs.

TRIAL #1:

Assume Inflow Volume = 19" of Runoff.

Available Storage upto the top of dam

$$= \frac{4570 \times 4.5}{45 \times 640}$$
$$= 0.723 \text{ ft}$$
$$= 8.44 \text{ inches.}$$

$$\frac{\text{Retaining detention volume}}{\text{Inflow runoff Volume}} = \frac{8.44}{19}$$
$$= 0.45$$

Refering to Figure 17-11 in SCS NEH, SECTION 4

$$\frac{\text{OUTFLOW PEAK RATE}}{\text{INFLOW PEAK RATE}} = 0.70$$

$\therefore$ OUTFLOW PEAK RATE = 0.7 x 62,250

= 43,575 cfs — Too high in value

TRIAL #2:

Consider available Storage upto 5 feet above the top of dam.

FAY SPOFFORD & THORNDIKE INC
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BOSTON

PROJECT EN-006(7)

FILE NUMBER EN-006

SHEET NUMBER 12

DATE 4-2-1970

COMPUTED BY VBM

CHECKED BY

SUBJECT SWIMPSETT TWIN DAM

TO DETERMINE PEAK OUTFLOW

Available storage upto 5 feet above top of dam of 9.5 feet above spillway crest

$$= \frac{4550 \times 9.5}{45 \times 640}$$

$$= 1.484 \text{ ft}$$

$$= 17.81 \text{ inches}$$

$$\frac{\text{Swimpsett Lake detention volume}}{\text{Inflow Runoff volume}} = \frac{17.81}{19.00}$$

$$= 0.94$$

$$\therefore \frac{\text{OUTFLOW PEAK RATE}}{\text{INFLOW PEAK RATE}} = 0.08$$

$$\therefore \text{OUTFLOW PEAK RATE} = 0.08 \times 65,250 \text{ cfs}$$

$$= 5220 \text{ cfs} \qquad (1)$$

From the composite rating curve, the above outflow peak rate corresponds to ELE. 1098.9

i.e. surcharge height above spillway crest

= 8.4 feet.

FAY, SPOFFORD & THORNDIKE, INC
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BOSTON

PROJECT EN-111(7)

FILE NUMBER EN-111
SHEET NUMBER 13
DATE 11-4-1958
COMPUTED BY [illegible]
CHECKED BY

SUBJECT SWIFT TOWN DAM
TO DETERMINE PEAK OUTFLOW

TRIAL #3:

Volume of Surcharge $(STOR_1) = \frac{4500 \times 8.4}{45 \times 640}$

$= 15.75''$.

∴ PEAK OUTFLOW $Q_{P_2} = Q_{P_1}\left(1 - \frac{STOR_1}{19}\right)$ (A)

$= 65\,250\left(1 - \frac{15.75}{19}\right)$

$= 65,250\,(1 - 0.829)$

$= 11,158$ cfs. (2)

TRIAL #4:

From the Composite rating curve, the above outflow peak rate corresponds to ELE. 1101.3

i.e. Surcharge ft. above Spillway Crest =

$= 10.8$ ft.

Vol. of Surcharge $(STOR_2) = \frac{4500 \times 15.9}{45 \times 640}$

$= 20.25''$ of runoff $> 19''$

∴ The above formula (A) does not work.

$\frac{\text{Outflow Peak Rate}}{\text{Inflow Peak Rate}} = \frac{11\,158}{65\,250} = 0.171$.

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BOSTON

PROJECT EN-006(7)

FILE NUMBER EN-006
SHEET NUMBER 14
DATE 10-4-1978
COMPUTED BY VRM
CHECKED BY

SUBJECT SUNAPEE TOWN DAM

TO DETERMINE PEAK OUTFLOW

Referring to Figure 17-11 in SCS NEH, SECTION 4, we

get $\frac{\text{Surcharge Volume}}{\text{Inflow Runoff Volume}} = = 0.88$

∴ Surcharge Volume = $0.88 \times 19 = 16.72''$

Now, apply the above eqn (A)

PEAK OUTFLOW $Q_{P_2} = 65250\left(1 - \frac{16.72}{19}\right)$

$= 65,250\,(1 - 0.88)$

$= 65250 \times 0.12$

$= 7830$ cfs. (3)

TRIAL #5:

From the composite rating curve, the above outflow Peak Rate & Ave. Ponds to ELE. 1099.9
i.e. Surcharge ht. above spillway crest = 9.4 ft

∴ Vol. of Surcharge (STOR$_1$) $= \frac{4500 \times 9.4}{45 \times 640}$

$= 17.625''$ of runoff

Now, apply the above eqn (A)

PEAK OUTFLOW $Q_{P_2} = 65250\left(1 - \frac{17.625}{19}\right)$

$= 65250(1 - .9276)$

PEAK OUTFLOW Q_{P_2} = 65,250 × 0.0724
= 4724 cfs (4)

TRIAL #6:

From the composite rating curve, the above outflow peak rate corresponds to ELE. 1096.6
∴ Surcharge = 8.1'.

Vol. of surcharge (STOR$_1$) = $\frac{4500 \times 8.1}{45 \times 640}$

= 15.1875" of runoff.

Now, apply the above eqn (A)

PEAK OUTFLOW Q_{P_2} = $65,250\left(1 - \frac{15.1875}{19}\right)$

= $65,250\left(1 - 0.799\right)$

= 65,250 × 0.201

= 13,115 cfs (5)

TRIAL #7:

From the composite rating curve, the above outflow peak rate corresponds to ELE. 1102.1
∴ Surcharge = 11.6 feet.

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BOSTON

PROJECT EM-006(7)

FILE NUMBER E11-006
SHEET NUMBER 16
DATE 12-4-1970
COMPUTED BY VRM
CHECKED BY

SUBJECT SUNAPEE TOWN DAM

TO DETERMINE PEAK OUTFLOW.

Vol. of Surcharge (STOR$_1$) $= \frac{4500 \times 11.6}{45 \times 640}$

$= 21.75''$ of runoff $> 19''$

∴ The above formula (A) does not work.

$\frac{\text{Outflow Peak Rate}}{\text{Inflow Peak Rate}} = \frac{13115}{65250} = 0.20$

Referring to Figure 17-11 in SCS NEH, SECTION 4, We

get $\frac{\text{surcharge Vol}}{\text{Inflow runoff Vol}} = 0.85$

∴ Surcharge Vol $= 0.85 \times 19$

$= 16.15''$ of runoff.

Now, apply the above eqn (A)

PEAK OUTFLOW $Q_{P_2} = 65250\left(1 - \frac{16.15}{19}\right)$

$= 65,250\,(1 - 0.85)$

$= 65,250 \times 0.15$

$= 9787.0$ cfs. (6).

FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON

PROJECT EM-306 (7)

FILE NUMBER EM-106

SHEET NUMBER 17

DATE 10-4-[illegible]

COMPUTED BY [illegible]

CHECKED BY

SUBJECT SUNAPEE TOWN DAM

TO DETERMINE PEAK OUTFLOW

TRIAL 2:

From the Composite routing curve, the above outflow Peak rate corresponds to ELE. 1150.8

$\therefore$ surcharge = 10.3 ft.

$\therefore$ Vol. of Surcharge (storage) $= \frac{4500 \times 10.3}{45 \times 640}$

$= 19.31$ inches of runoff > 19"

$\therefore$ The above formula (A) does not work.

$\frac{\text{Outflow Peak Rate}}{\text{Inflow Peak Rate}} = \frac{9787}{65,250} = 0.14999$

$\simeq 0.15$

Referring to Figure 17-11 in SCS NEH, SECTION 4

One gets $\frac{\text{Surcharge Vol.}}{\text{Inflow runoff Vol}} = 0.89$

$\therefore$ Surcharge Vol $= 0.89 \times 19 = 16.91$" of runoff

NOW, apply the above eqn. (A).

PEAK OUTFLOW $Q_{P_2} = 65,250\left(1 - \frac{16.91}{19}\right)$

$= 65,250(1 - 0.89)$

$= 7178$ cfs. (7).

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EN-606(7)

FILE NUMBER EN-606
SHEET NUMBER 12
DATE 12-4-[illegible]
COMPUTED BY [illegible]
CHECKED BY

SUBJECT SUNAPEE TOWN DAM
TO DETERMINE PEAK OUTFLOW

TRIAL #9:

From the composite routing curve, the above Peak Rate corresponds to ELE. 1099.7
∴ Surcharge = 9.2 ft

∴ Vol. of Surcharge (STOR$_1$) = $\frac{4500 \times 9.2}{45 \times 640} \times 12$

= 17.25" of run

Now, apply the above equation (A)

PEAK OUTFLOW $Q_{P_2} = 65,250 \left(1 - \frac{17.25}{19}\right)$

$= 65,250 (1 - 0.90789)$

$= 6010$ cfs (8)

TRIAL #10:

From the composite routing curve, the above PEAK OUTFLOW RATE corresponds to ELE. 1099.2
∴ Surcharge = 8.7 ft.

∴ Vol. of Surcharge (STOR$_1$) = $\frac{4500 \times 8.7}{45 \times 640} \times 12$

= 16.3125 inches of runoff.

Now, apply the above eqn. (A)

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EN-606 (7)

FILE NUMBER EN-606
SHEET NUMBER 19
DATE 16-4-1978
COMPUTED BY KBM
CHECKED BY

SUBJECT SUMMER TOWN DAM
TO DETERMINE PEAK OUTFLOW.

PEAK OUTFLOW $Q_{P_2} = 65,250\left(1 - \frac{16.125}{19}\right)$

$= 65,250(1 - .8585)$

$= 65,250 \times 0.1415$

$= 9233.0$ cfs. (9)

TRIAL #11:

AVERAGE PEAK OUTFLOW $= \frac{6010 + 9233.}{2}$

$= 7622.0$ cfs. (10)

From the composite rating curve, the above PEAK OUTFLOW RATE corresponds to ELE. 1099.9

∴ surcharge = 9.4 ft.

∴ Vol. of surcharge (STOR$_1$) $= \frac{4500 \times 9.4 \times 12}{45 \times 640}$

$= 17.625$" of runoff.

Now, apply the above eqn. (A)

Peak outflow $Q_{P_2} = 65,250\left(1 - \frac{17.625}{19}\right)$

$= 65,250(1 - 0.9276)$

$= 65,250 \times 0.0724$

$= 4724$ cfs. (11)

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EN-006(7)

FILE NUMBER EN-006
SHEET NUMBER 20
DATE 10-A-1972
COMPUTED BY VBM
CHECKED BY

SUBJECT SUNAPEE TOWN DAM.
TO DETERMINE PEAK OUTFLOW.

TRIAL #12:

From the composite rating curve, the above PEAK OUTFLOW RATE corresponds to ELE. 1078.7

$\therefore$ Surcharge = 8.7 feet.

$\therefore$ Vol. of Surcharge (STOR$_1$) $= \frac{4500 \times 8.7}{45 \times 640} \times 12$

$= 16.3125$ inches of runoff.

NOW, apply the above eqn. (A)

PEAK OUTFLOW $Q_{P_2} = 65,250\left(1 - \frac{16.3125}{19}\right)$

$= \underline{9233.0 \text{ CFS}}$

$\therefore$ PEAK OUTFLOW = 9233.0 CFS.

SURCHARGE (above spillway crest) = 8.7 feet.

AMOUNT OF OVERTOPPING OF DAM = 4.2 feet.

FAY SPOFFORD & THORNDIKE INC
ENGINEERS
BOSTON

PROJECT EM-006 (7)

FILE NUMBER

SHEET NUMBER 21

DATE 5-1-79

COMPUTED BY E.J.

CHECKED BY

SUBJECT SUNAPEE TOWN DAM

ROUTING COMPS FOR 1/2 PMF

Try 4.7' surcharge

$$STOR = \frac{4.7(4500)}{45(53)} = 8.8"$$

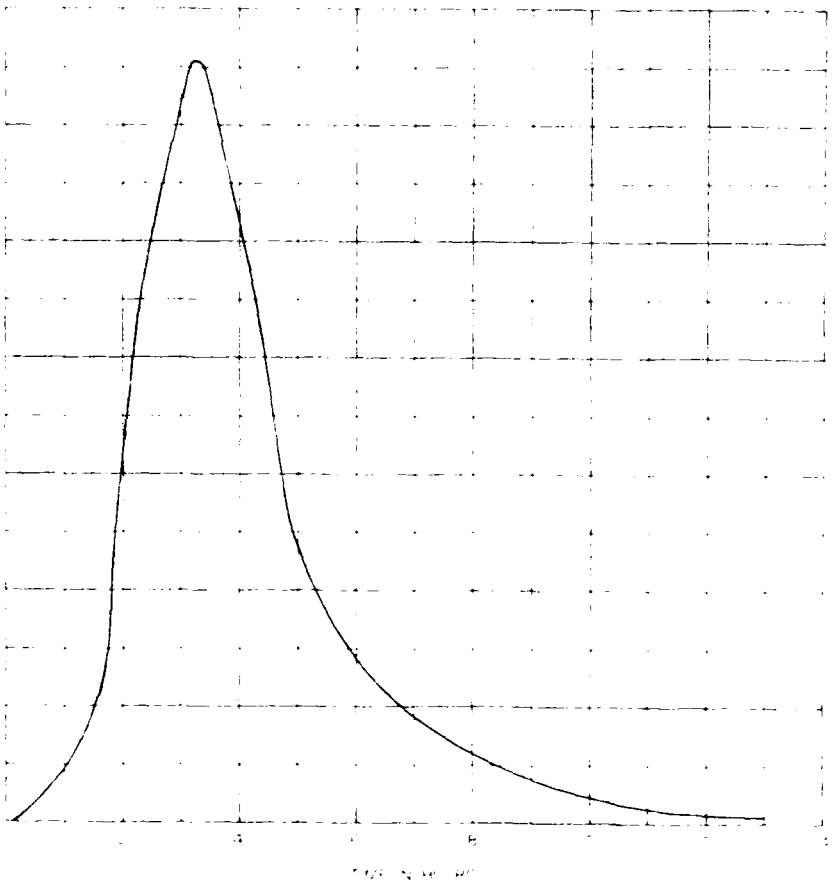
$$Q_{p2} = 32,500\left(1 - \frac{8.8}{9.5}\right) = 2405 \text{ (LITTLE HIGH)}$$

Try 4.8' surcharge

$$STOR = \frac{4.8(4500)}{(45)(53)} = 9.0"$$

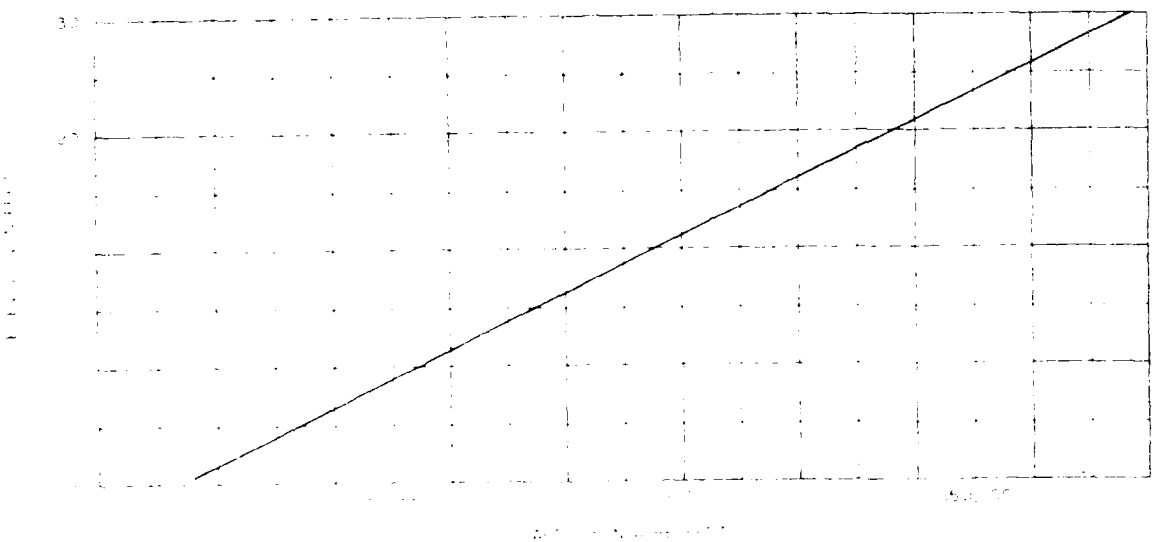
$$Q_{p2} = 32,500\left(1 - \frac{9.0}{9.5}\right) = 1720 \text{ cfs} \quad (OK)$$

Pool El. = 1090.3 + 4.8 = 1095.3 ft msl.



SPILLWAY TEST FLOOD INFLOW HYDROGRAPH

SUNAPEE TOWN DAM

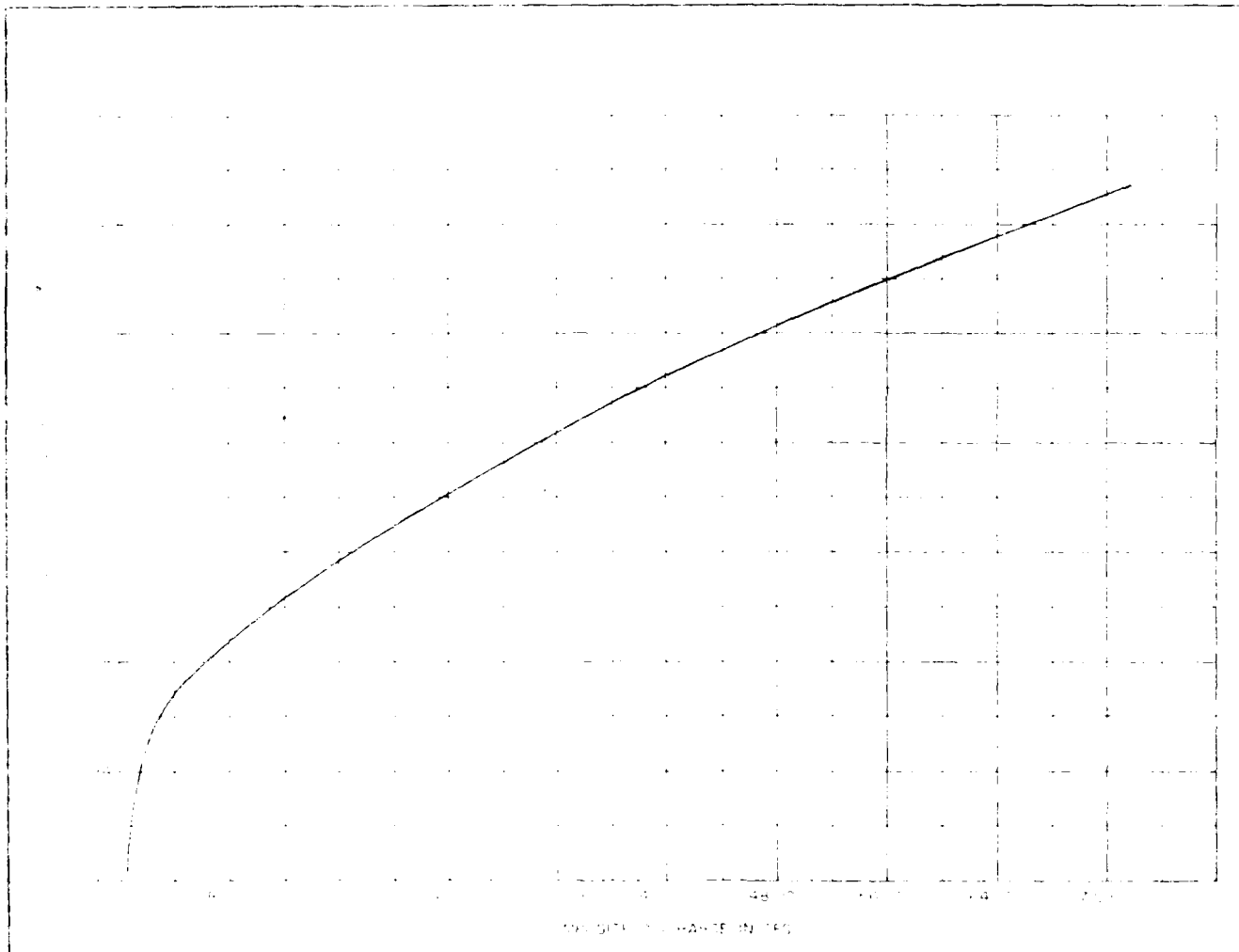


STORAGE CAPACITY - ELEVATION CURVE

[illegible] ASSOCIATES THORNDIKE, INC. ENGINEERS BOSTON, MASS.	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

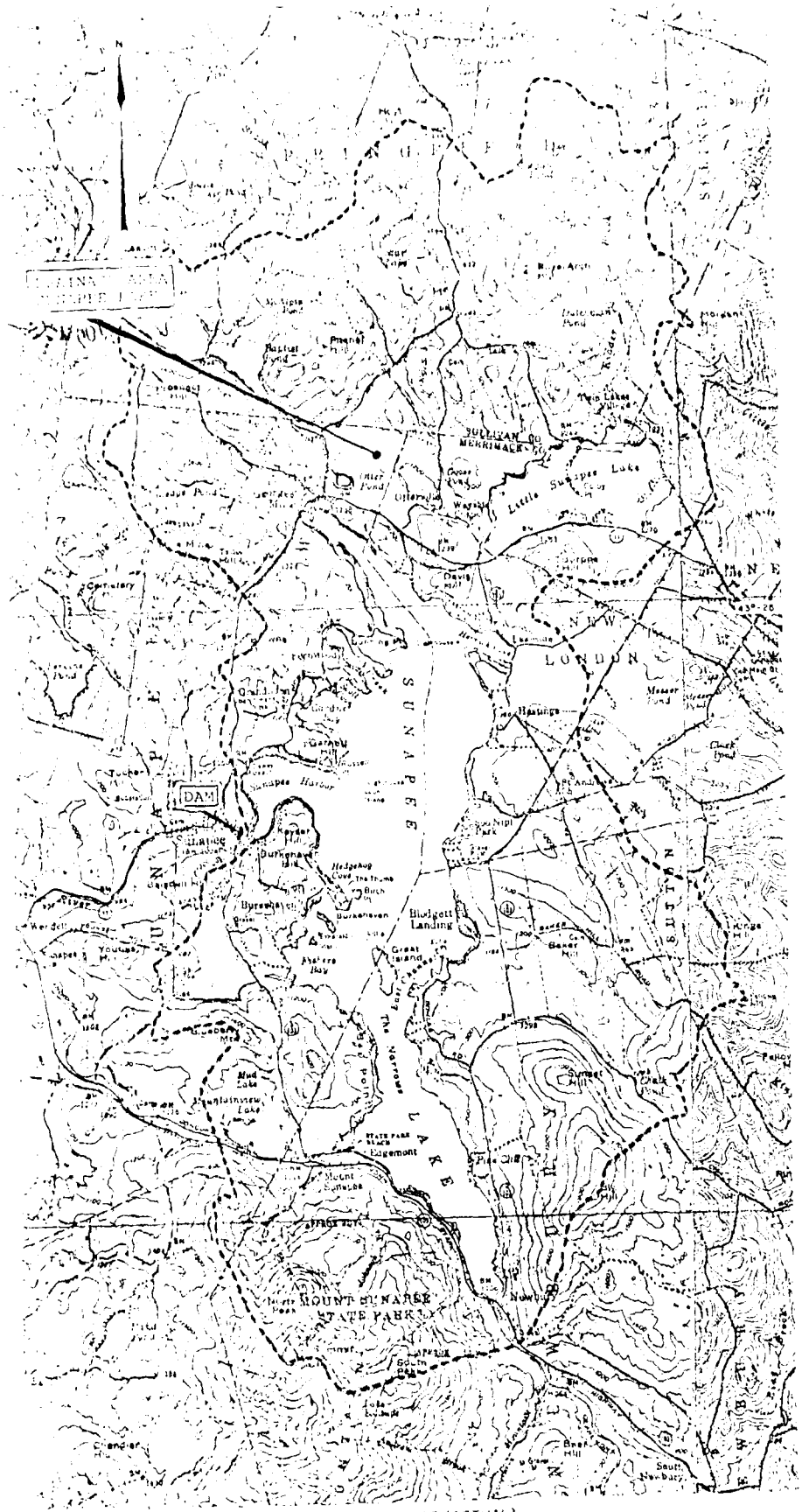
SUNAPEE TOWN DAM



RATING CURVE (COMPOSITE) FOR SPILLWAY AND DAM

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAM

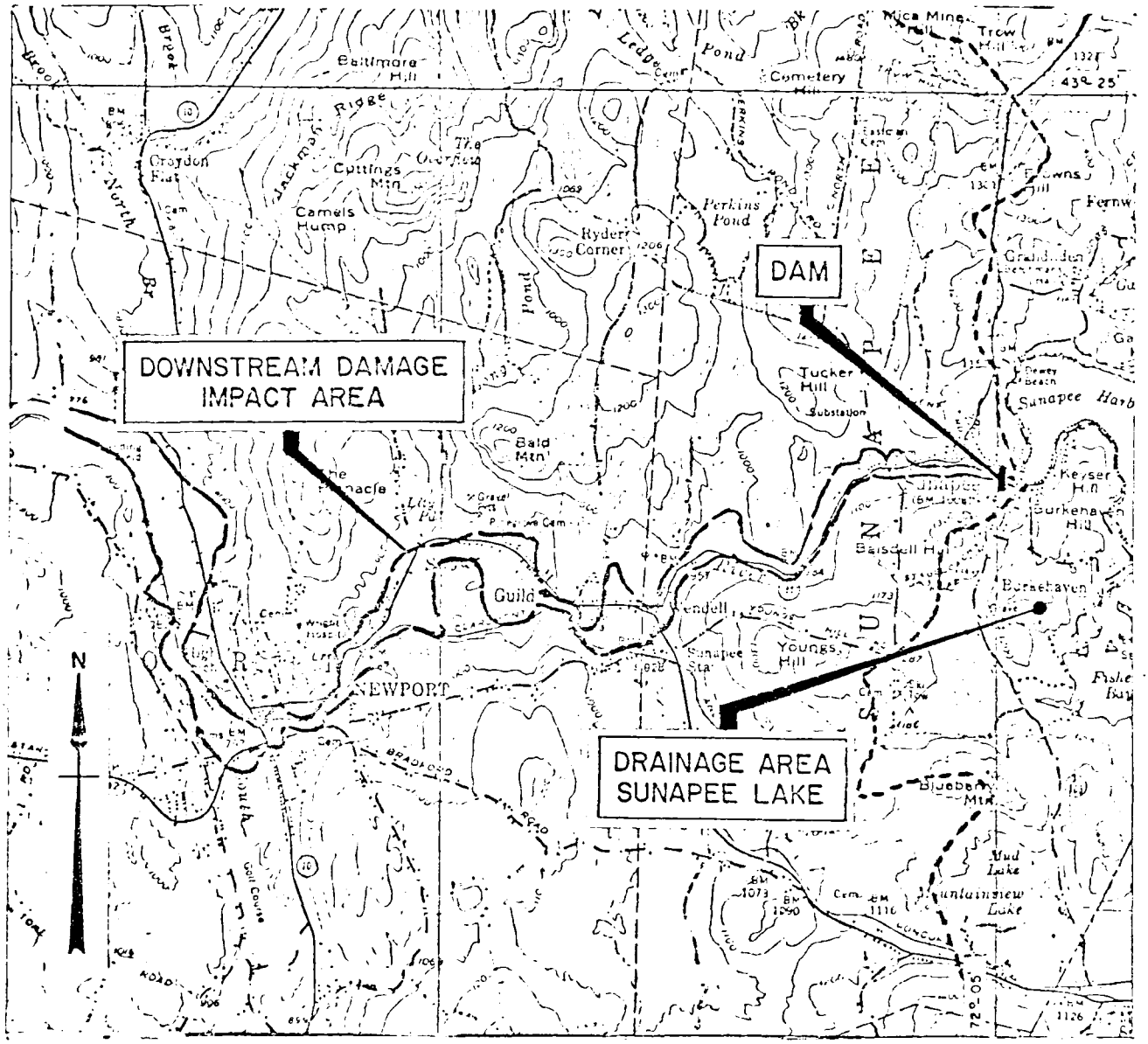
SUNAPEE TOWN DAM



SCALE 1:62500 (ACTUAL)

UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

NEW HAMPSHIRE
SUNAPEE QUADRANGLE 1955
AMS 6570 I-SERIES V712
MT KEARSARGE QUADRANGLE 1956
AMS 6670 IV-SERIES V712



SCALE 1:62500 (ACTUAL)

UNITED STATES
DEPARTMENT OF INTERIOR
GEOLOGICAL SURVEY

NEW HAMPSHIRE

SUNAPEE QUADRANGLE 1955
AMS 6570 I-SERIES V712

MT. KEARSARGE QUADRANGLE 1956
AMS 6670 IV-SERIES V712

APPENDIX E

INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) NAME	(9) LATITUDE (NORTH)	(10) LONGITUDE (WEST)	(11) REPORT DATE DAY	MO	YR
	105	NED	NH	019	02		SUNAPEE LAKE DAM NO.	4325.1	7204.9	06	AUG	78

(12) POPULAR NAME	(13) NAME OF IMPOUNDMENT
SECOND DAM	SUNAPEE LAKE

(14) STATE	(15) BASIN	(16) RIVER OR STREAM	(17) NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	(18) DIST FROM DAM (MI)	(19) POPULATION
01	08	SUGAR RIVER	SUNAPEE	0	1400

(20) TYPE OF DAM	(21) YEAR COMPLETED	(22) PURPOSES	(23) STRUCTURAL HEIGHT (FT)	(24) HYDRAULIC HEIGHT (FT)	(25) IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT)	NORMAL (ACRE-FT)	(26) DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
GRCTPG	1932	RS	15	13	32500	10340	NED	N	N	N	N	11SEP78

(27) REMARKS

(28) DAM HAS	(29) SPILLWAY CREST LENGTH (FT)	(30) TYPE	(31) WIDTH (FT)	(32) MAXIMUM DISCHARGE (CFS)	(33) VOLUME OF DAM (CY)	(34) POWER CAPACITY INSTALLED (MW)	(35) PROPOSED (MW)	(36) NO	(37) LENGTH (FT)	(38) WIDTH (FT)	(39) NAVIGATION LOCKS LENGTH (FT)	(40) WIDTH (FT)	(41) LENGTH (FT)	(42) WIDTH (FT)	(43) LENGTH (FT)	(44) WIDTH (FT)
1	71	C	30	720												

(45) OWNER	(46) ENGINEERING BY	(47) CONSTRUCTION BY
TOWN OF SUNAPEE	I W JONES & CO ENGRS	CANSBY BROS OF SUNAPEE

(48) REGULATORY AGENCY DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NH WATER RES BD	NH WATER RES BD	NH WATER RES BD	NH WATER RES BD

(49) INSPECTION BY	(50) INSPECTION DATE DAY	MO	YR	(51) AUTHORITY FOR INSPECTION
RAY SPOFFORD & THORNDIKE, INC.	06	JUN	78	PL92-367

(52) REMARKS

END

FILMED

8-85

DTIC